PRICE $2.00

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT

COLOR BAR AND DOT GENERATOR

MODEL IG-62

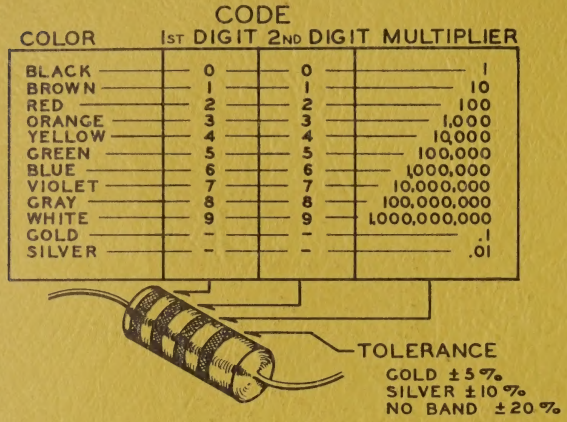
RESISTOR AND CAPACITOR COLOR CODES

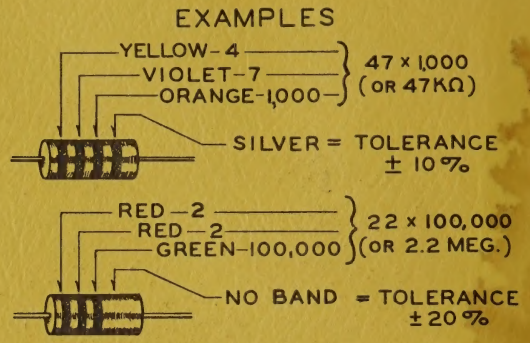
RESISTORS

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistor, the first band represents the first digit of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of ±5% or ±10% respectively. The absence of a fourth band indicates a tolerance of ±20%.

The physical size of a composition resistor is related to its wattage rating. Size increases progressively as the wattage rating is increased. The diameters of 1/2 watt, 1 watt and 2 watt resistors are approximately 1/8", 1/4" and 5/16", respectively.

The color code chart and examples which follow provide the information required to identify color coded resistors.

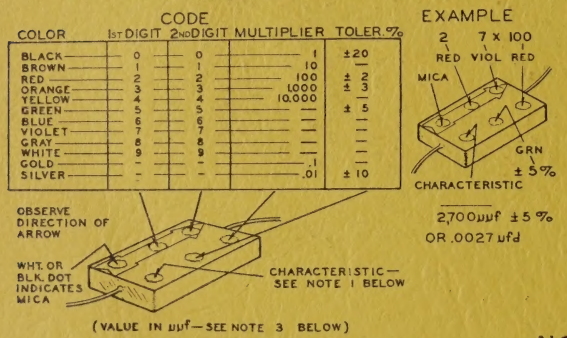




CAPACITORS

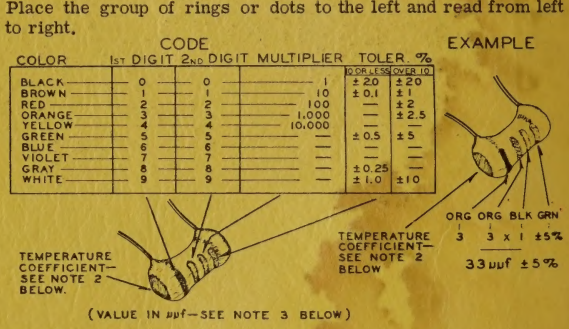
Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

MICA



TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.


CODE
COLOR
1ST DIGIT
2ND DIGIT
MULTIPLIER
TOLER. %
10 OR LESS
OVER 10
BLACK 0 0 1 ±20 ±20
BROWN 1 1 10 ±0.1 ±1
RED 2 2 100 — ±2
ORANGE 3 3 1,000 — ±2.5
YELLOW 4 4 10,000 — —
GREEN 5 5 — ±0.5 ±5
BLUE 6 6 — — —
VIOLET 7 7 — — —
GRAY 8 8 — ±0.25 —
WHITE 9 9 — ±1.0 ±10
EXAMPLE
ORG ORG BLK GRN
3 3 x 1 ±5%
33 μμf ±5%
TEMPERATURE COEFFICIENT— SEE NOTE 2 BELOW.
TEMPERATURE COEFFICIENT— SEE NOTE 2 BELOW
(VALUE IN μμf—SEE NOTE 3 BELOW)

NOTES:

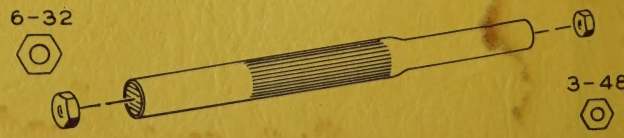
1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μfd (microfarad, .000001 farad) and μμf (micro-micro-farad, .000001 μfd); therefore, 1,000 μμf = .001 μfd, 1,000,000 μμf = 1μfd. The designation pf is sometimes used for μμf.

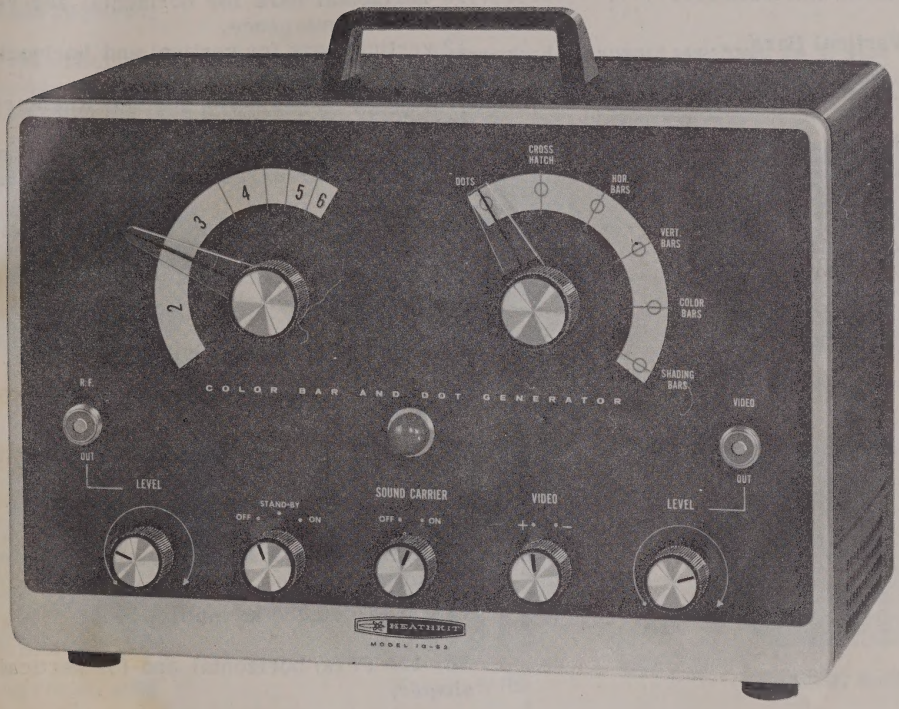
USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.



ASSEMBLY AND OPERATION OF THE HEATHKIT COLOR BAR AND DOT GENERATOR

MODEL IG-62



SPECIFICATIONS

RF Output Frequency Range:..... 50 mc to 90 mc; TV channels 2 through 6. Output voltage variable from approximately 100 to 100,000 microvolts.

Sound Carrier:..... Crystal controlled unmodulated. 4.5 mc away from picture carrier. Off-on switch provided.

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7/30/65

Video Output:..... Positive or negative output variable from 0 to 10 volts peak-to-peak open circuit. Source impedance approximately 1,000 ohms.

Modulation:..... All frequencies are crystal controlled providing horizontal and vertical sync pulses for steady, locked-in patterns.

Dots:..... 180 small size (approx. 2 lines) white dots (less those lost in blanking) for accurate convergence adjustments.

Crosshatch:..... 12 vertical and 15 horizontal lines (less those lost in blanking) for height, width, and linearity adjustments.

Horizontal Bars:..... 15 horizontal bars for horizontal and vertical dynamic convergence.

Vertical Bars:..... 12 vertical bars for vertical and horizontal dynamic convergence.

Color Bars:..... 10 vertical color bars for the alignment and trouble-shooting of chroma circuits.

Shading Bars:..... Wide bar crosshatch pattern with four shades of brightness, for screen and background adjustments.

Power Supply:..... Transformer operated with 2 silicon rectifiers.

Power Requirement:..... 117 volts AC, 50-60 cycles, 70 watts.

Tube Complement:..... V1, 12AT7 (a) 189 kc master crystal oscillator and (b) bar shaper;

V2, 12AT7 31.5 kc multivibrator;

V3, 12AU7 4500 cycle multivibrator;

V4, 12AU7 900 cycle multivibrator;

V5, 12AU7 60 cycle multivibrator;

V6, 12AT7 (a) 3.564 mc crystal oscillator and (b) burst gate;

V7, 12AT7 15.750 kc multivibrator;

V8, 12AT7 (a) horizontal and (b) vertical sync shaper;

V9, 12AT7 (a) 189 kc and (b) 900 cycle bar shaper;

V10, 12AU7 (a) phase inverter and (b) cathode follower video output;

V11, OB2 voltage regulator;

V12, 6BQ7 (a) 4.5 mc crystal oscillator and (b) RF oscillator;

V13, 6CS6 RF modulator and output.

Output Cable:..... 4' output cable with alligator clips.

Dimensions:..... 13" wide x 8 1/2" high x 7" deep.

Net Weight:..... 10 pounds

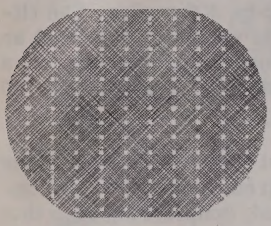
Shipping Weight:..... 12 pounds

INTRODUCTION

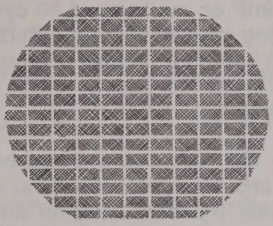
The Heathkit Color Bar and Dot Generator has been designed to give the color television technician a versatile, portable service instrument that has crystal-controlled accuracy and stability at a cost that is within his budget, combined with other time and labor saving features that enable him to perform the many setup and service procedures found in color television receivers as well as the width and linearity adjustments of black-and-white receivers.

Incorporated in the Heathkit Color Bar and Dot Generator are horizontal and vertical sync pulses, crystal controlled to the same frame rate as the TV station. These pulses provide the necessary blanking and lock the various patterns firmly on the screen without jitter or crawl. The user therefore may be assured that color receivers converged with the Generator will still be converged properly on a television program from a station. Also, there are no bothersome external sync leads required.

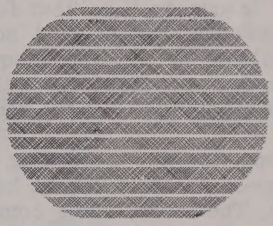
Dots, crosshatch and bars are small size and sharply defined and are fixed as to size and number enabling the technician to know exactly the height and width of the raster. Also he can select with one switch the type of pattern he wants to use.



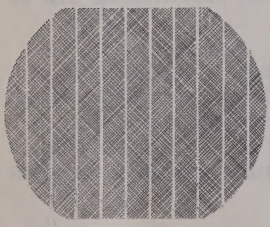
DOT PATTERN



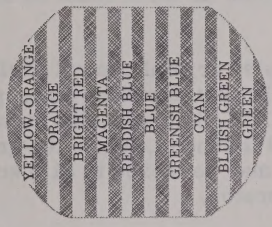
CROSSHATCH



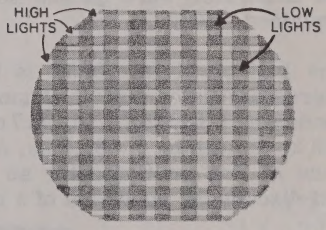
HORIZONTAL BARS



VERTICAL BARS



COLOR BARS



SHADING BARS

Ten vertical color bars are displayed, using a crystal-controlled, offset carrier method giving the following colors from left to right when the hue control of the color set is in the center of its range: (1) yellow-orange, (2) orange, (3) red, (4) magenta, (5) reddish-blue, (6) blue, (7) greenish-blue, (8) cyan, (9) bluish-green, (10) green. Using these bars, AFC, phase and matrix alignment may be performed. A white leading edge and black trailing edge are provided on the color bars to check color fit.

Shading bars as provided for the adjustment of screen and background controls. As technicians familiar with these adjustments have found, it is sometimes harder to achieve correct gray scale tracking than it is to adjust convergence. To assist in this, the Generator provides a wide bar cross-hatch pattern called shading bars producing four levels of brightness on the screen. The brightest level is where the horizontal and vertical bars cross and may be called highlights. The vertical bars being of greater intensity than the horizontal bars become the next level followed by the horizontal bars. The space between the bars is the lowest level and may be called low-lights. Thus, there is a stationary pattern from highlights to low-lights to use in gray scale tracking instead of trying to find highlights and low-lights in a constantly changing picture from a station.

The Generator has RF output on any channel from 2 to 6 with an RF level control to check sensitivity and prevent overloading of the automatic gain control. Also a crystal controlled sound carrier with off/on switch is provided for adjusting the fine tuning control.

The video output for trouble-shooting video circuits may be adjusted with the video level control that also varies the RF modulation providing a check of color hue and sync with different signal levels.

The Generator is powered with an AC-operated, voltage-regulated, power supply using the new long life silicon rectifiers.

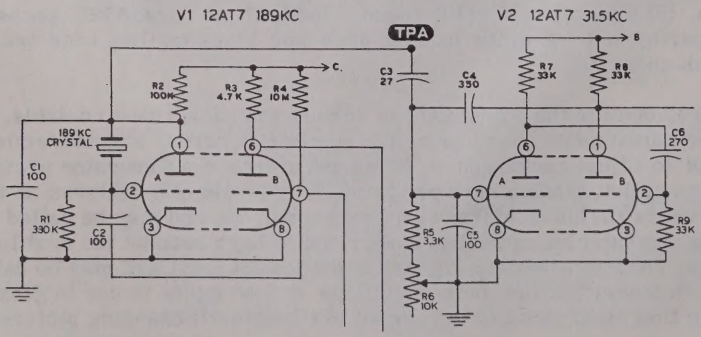
CIRCUIT DESCRIPTION

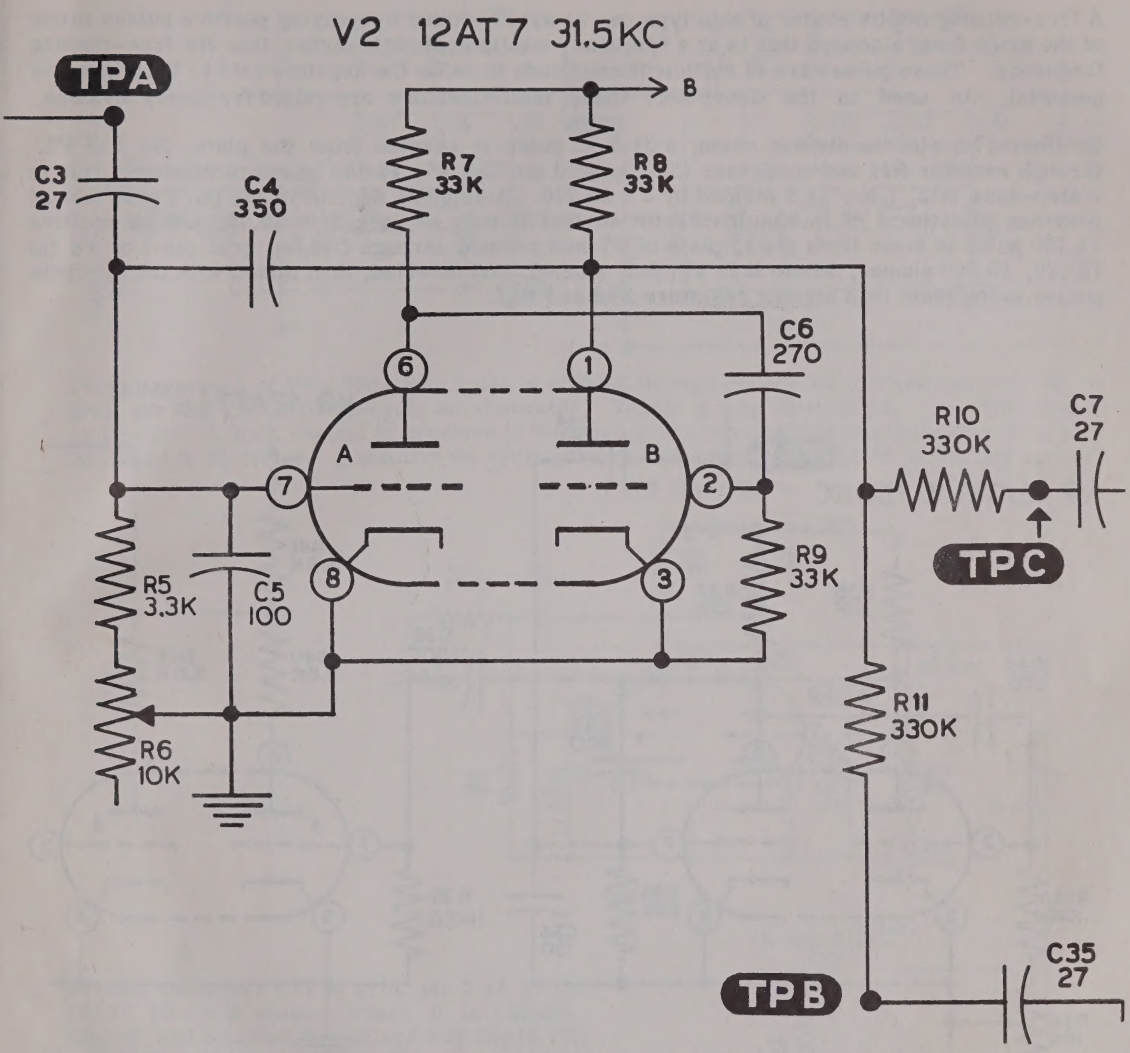
Because of the varied output pulses developed in the Generator, we will break the description down into sections, and trace them out on the circuit diagram, in order to install a better understanding of how it works. First, how the sync pulses are developed. Most technicians are familiar with the terminology of harmonics. That is, an oscillator operating at a given frequency will not only have output at that frequency, but numerous harmonics or multiples of that frequency, i.e., that fifth harmonic or multiple of 60 cycles would be 300 cycles. The fifteenth, 900 cycles, and so on. Using this harmonic relationship it is possible to control an oscillator at a given frequency by applying a signal from another oscillator operating at a harmonic or multiple of that given frequency, i.e., a 31.5 kc oscillator can control a 15.750 kc oscillator. 31.5 is the second harmonic of 15.750.

In applying the preceding theory in the Generator it can be seen that the desired sync pulse frequencies of 15.750 kc horizontal and 60 cycles vertical have no direct harmonic relationship. Therefore, some common divider for both of them must be found, considering also that it is not possible to use a harmonic which is too high and still maintain positive control. There are a number of different combinations that could be used, but the frequencies selected for the Generator were chosen so that some of them could be used for other functions as will be explained later.

One half of V1 (a) 12AT7 is the master crystal control oscillator using a 189 kc crystal in a Pierce oscillator circuit. A small 189 kc pulse from the plate, pin 1 of V1 (a) is coupled through condenser C3 to the grid, pin 7 of V2 12AT7, 31.5 kc multivibrator. This is a stepdown of 6, i.e., 189 kc divided by 6 = 31.5 kc. A 10,000 Ω control, R6, in the grid circuit of V2 provides adjustment of this multivibrator so that it may be locked to 31.5 kc. Let's pause here for a moment and discuss the operation of a multivibrator.

The multivibrators in the Generator are essentially the same except for resistor and condenser values. They all have small bypass condensers in their input grid circuits to bypass some of the high frequency signal. We will use V2, 31.5 kc multivibrator as an example. Observing the circuit, it is found that V2, 12AT7 dual triode is really two resistance capacitance coupled amplifier

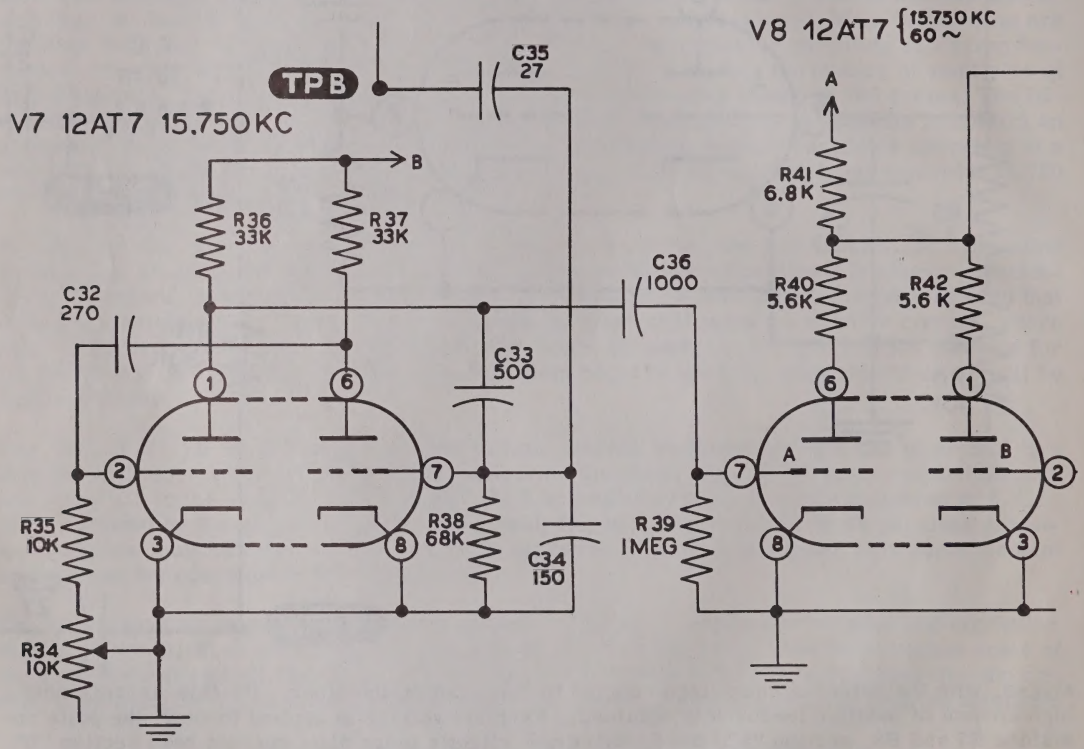




stages, with the output of each stage coupled to the input of the other. By this arrangement a high amount of positive feedback is obtained. As plate voltage is applied through the plate resistors R7 and R8, section "a", pin 6, will draw slightly more plate current than section "b". As a result of the feedback the plate current of section "a" will increase rapidly and the plate current of section "b", pin 1, will decrease to cutoff. The drop in plate voltage at pin 6 causes a negative step of voltage to appear at the grid pin 2 through coupling condenser C6. Because of the amplification of the tube, the grid voltage at pin 2 is driven well below cutoff. Condenser C6 tends to maintain this negative voltage, but its charge leaks off through grid resistor R9, at a rate determined by the value of C6 and R9. (These components are called RC networks which have definite time constants.) This, then, increases the grid voltage at pin 2. As this voltage reaches the cutoff value, plate current begins to flow at pin 1, decreasing plate voltage. The drop in negative potential thus developed at pin 1 is applied to grid pin 7 through coupling condenser C4, driving this grid to cutoff and repeating the above process. Hence, it can be seen that when one section of the tube is on, the other is off, the frequency being determined by the RC values selected.

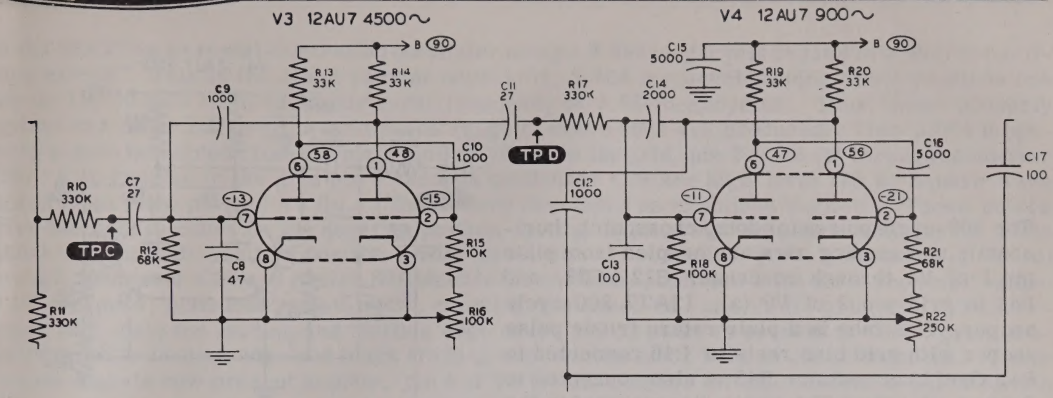
A free-running multivibrator of this type can be synchronized by applying positive pulses to one of the grids from a source that is at a frequency multiple slightly higher than its free-running frequency. These pulses are of sufficient amplitude to raise the negative grid to the triggering potential. As used in the Generator, these multivibrators are called frequency dividers.

Continuing on with the divider chain, a 31.5 kc pulse is coupled from the plate, pin 1 of V2, through resistor R11 and condenser C35, to grid pin 7 of V7, 15.750 kc multivibrator. This is a step-down of 2, i.e., 31.5 divided by 2 = 15.750. A 10,000Ω control in the pin 2 grid circuit provides adjustment of this multivibrator so that it may be locked to 15.750 kc. A positive 15,750 pulse is taken from pin 1, plate of V7 and coupled through C36, to grid pin 7 of V8 (a) 12AT7, 15.750 shaper, where it is clipped, shaped, and inverted, then mixed with the 60-cycle pulses in the plate load divider resistors R40 and R41.

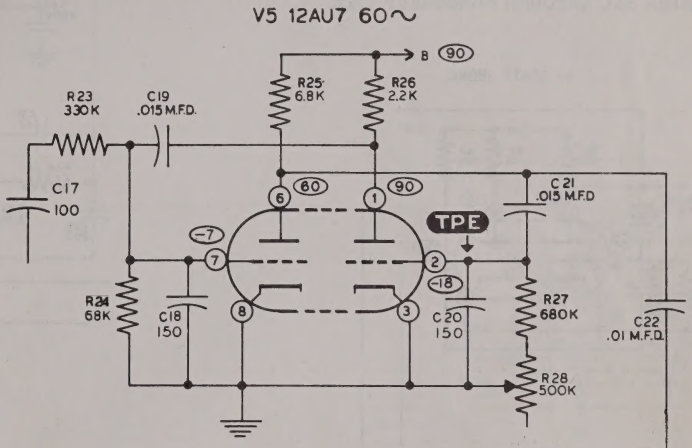


Again from plate pin 1 of V2 a 31.5 pulse is coupled through resistor R10 and condenser C7 to grid, pin 7 of V3, the 4500 cycle 12AU7 multivibrator. This is a step-down of 7, i.e., 31.5 kc divided by 7 = 4500~. A 100,000Ω control, R16 is provided in the pin 2 grid circuit of this multivibrator so that it may be locked to 4500 cycles.

From plate pin 1 of V3 a 4500 cycle pulse is coupled through condenser C11 and resistor R17 to grid, pin 7 of V4 12AU7 900 cycle multivibrator. This is a step-down of 5, i.e., 4500 divided by 5 = 900. A 250 KΩ (R22) control is provided in pin 2 grid circuit of this multivibrator so that it may be locked to 900 cycles. The 900 cycle pulses are used for horizontal bars as will be explained later.

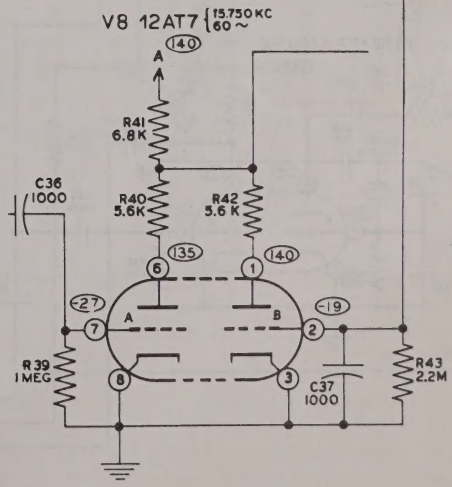


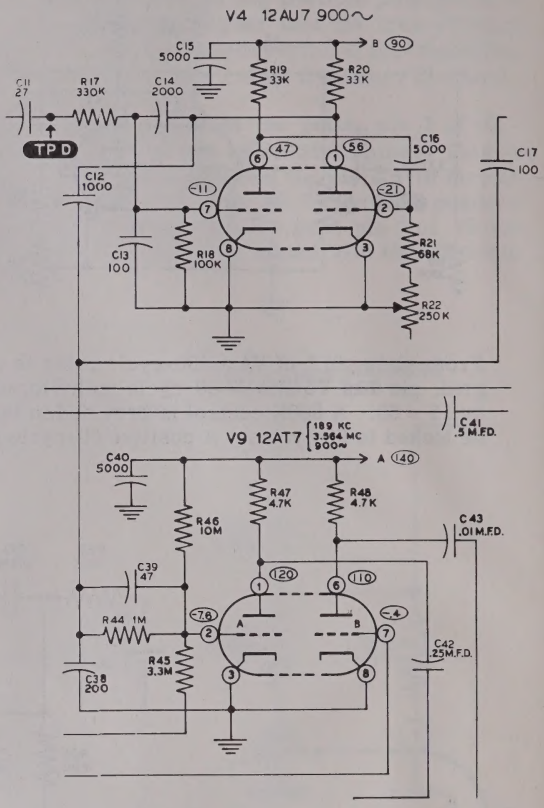
From plate pin 1 of V4 a 900-cycle pulse is coupled through condenser C17 and resistor R23 to grid, pin 7 of V5 12AU7 60-cycle multivibrator. This is a step-down of 15, i.e., 900 divided by 15 = 60. A 500K control is provided in the pin 2 grid circuit of this multivibrator so it may be locked to 60 cycles. A positive 60-cycle pulse is taken from plate pin 6 of V5 and coupled



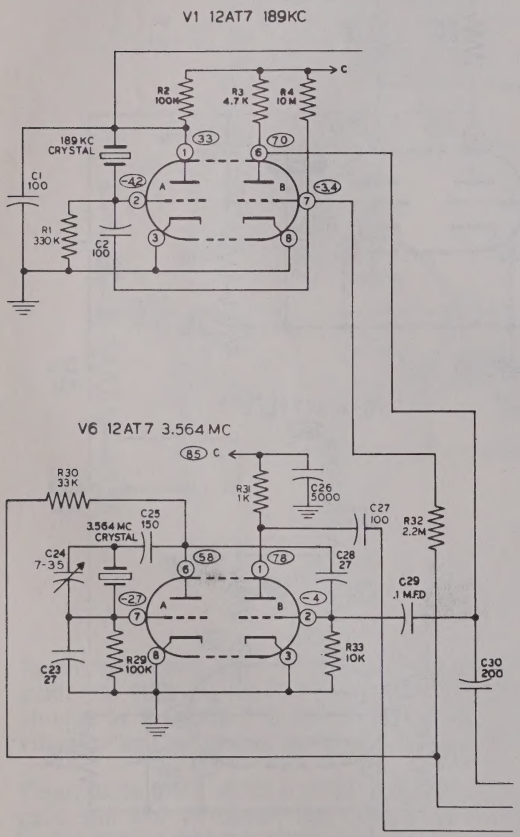
through condenser C22 to grid, pin 2 of V8 (b) 12AT7 60-cycle shaper, where it is clipped, shaped, and inverted, then mixed with the 15.750 kc pulses in the plate load divider resistor R41 and R42. Both 15.750 kc and 60-cycle pulses are coupled through condenser C41 and resistor R52 to grid pin 2 of V10, (a) 12AU7 video phase inverter. Resistors R40, R41, R42, R52, and condenser C41 maintain the DC component level.

Now that we have both 15.750 kc and 60-cycle sync pulses with crystal controlled accuracy, let us proceed to find out how the rest of the modulating pulses are developed.



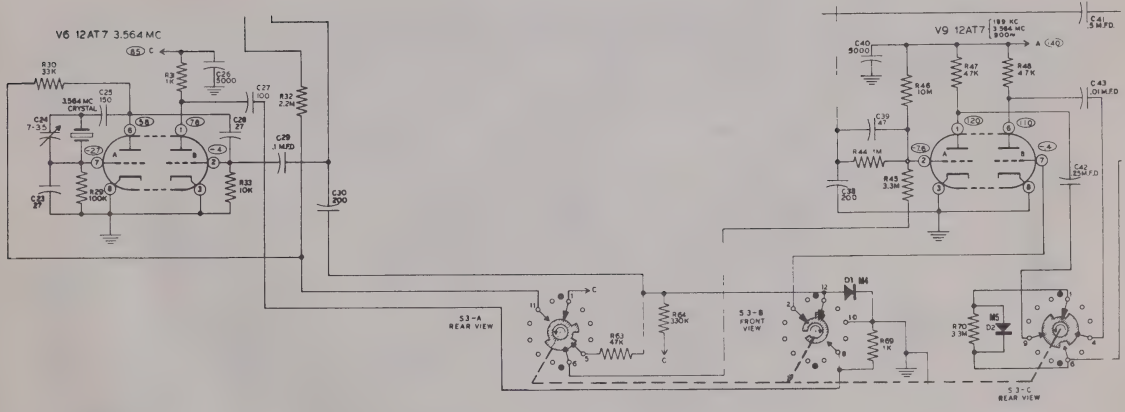


The 900-cycle pulses for dots, crosshatch, horizontal, and shading bars are coupled from plate pin 1 of V4 through condenser C12, C39, and R44 to grid pin 2 of V9 (a), 12AT7 900-cycle shaper. This tube is a plate return triode pulse shaper with grid bias resistor R46 connected to B+. Grid bias resistor R45 is also connected to B+ through switch S3A and is disconnected in the shading bar position producing wider horizontal bars. A pulse that is clipped, shaped and inverted appears at plate pin 1 and is applied to switch S3C through condenser C42.



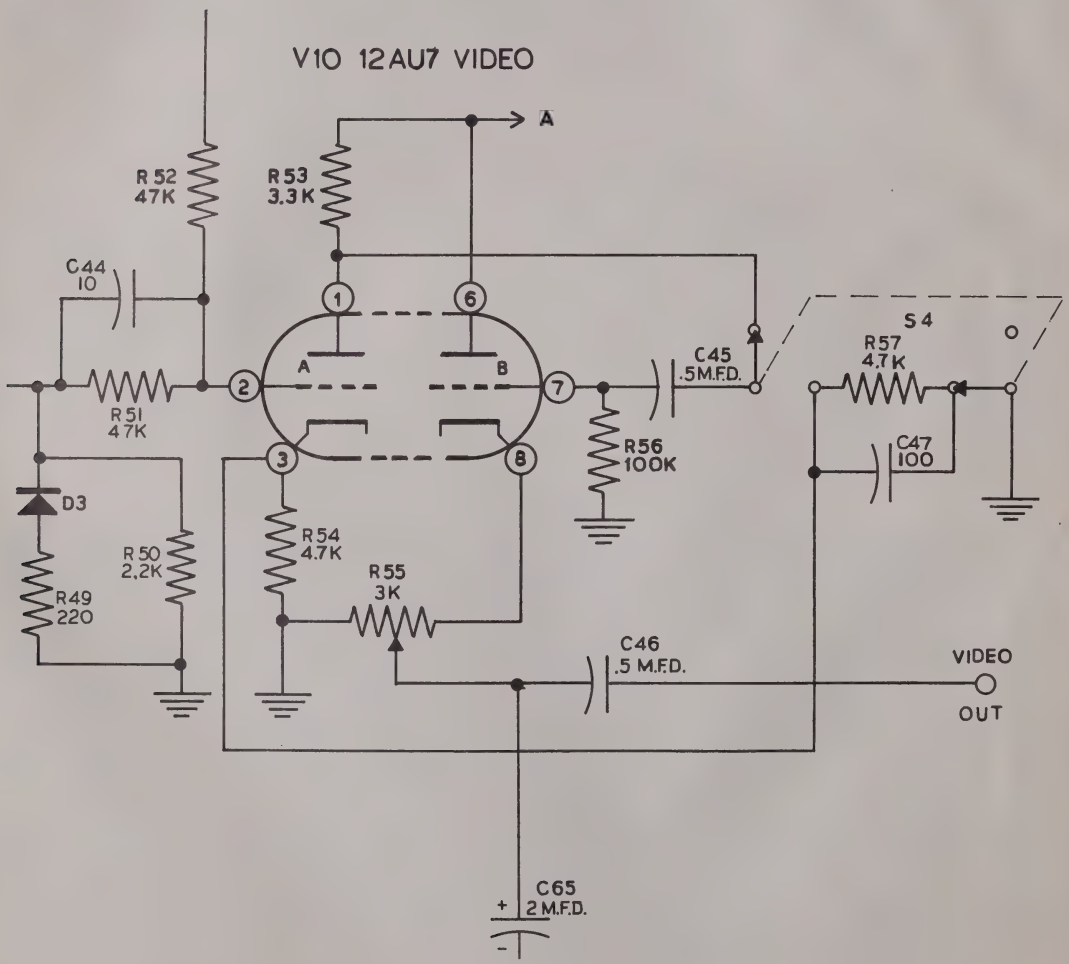
The 189 kc pulses for dots, crosshatch, vertical, color and shading bars are coupled from grid pin 2 of V1 (a) to grid pin 7 of V1 (b) through condenser C2. This section of the tube is a triode pulse shaper with grid pin 7 positively biased by resistor R4 when switch S3A is in dots, crosshatch, vertical bars and shading bars positions. In the color bar position, resistor R32 is switched in parallel with R4 forming wider pulses for color bars. In dots, crosshatch, vertical bars, and shading bars, position, pulses from plate pin 6 of V1 (b) are coupled to grid pin 7 of V9 (b) 12AT7 189 kc bar shaper, through condenser C30 and switch S3B. Resistor R63 and R64 provide positive grid bias to V9 (b) grid, (pin 7). When switch S3A is in the shading bar position R63 is disconnected, forming wider bars. Diode D1 clamps V9 grid (pin 7) preventing overshoot.

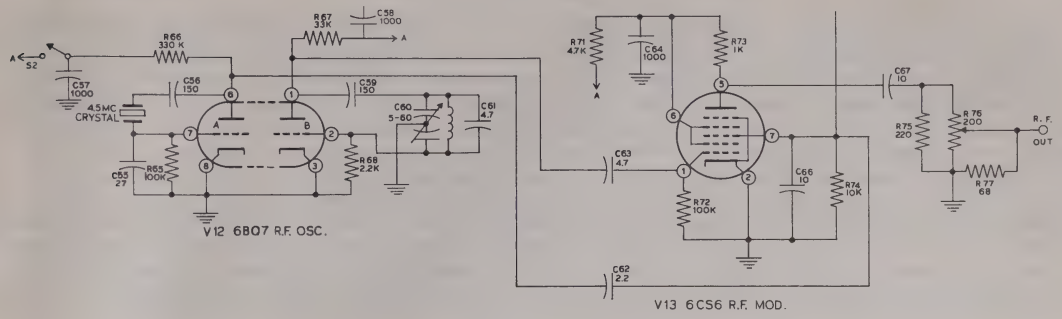
V6 (a) 12AT7 is a crystal-controlled oscillator using a 3.564 megacycle crystal in a Pierce oscillator circuit. This is the offset carrier oscillator, 3.564 megacycles being offset or minus one line or 15,750 kc's from the color burst frequency of 3.58 megacycles. Thus, when properly applied to a color receiver, a continuous range of color hues are produced. This 3.564 megacycle signal is coupled from the plate pin 6 of V6 (a) to the grid, pin 2 of V6 (b) through condenser C28. Also coupled to the grid pin 2 through condenser C29 are high level 189 kc square wave pulses from plate pin 6 of V1 (b). (These were developed as explained earlier.) These pulses drive the grid to cutoff on the negative portion, gating or allowing the tube to conduct the 3.564 signal only on their positive portion. This gated signal is applied to the grid pin 7 of V9 (b) through condenser C27 and switch S3B when in the color bar position. Because of the small values of V6 (b) (pin 1) plate load resistor R31, coupling condenser C27 and V9 (b) grid, (pin 7) bias resistor R69, only the leading and trailing edge of the 189 kc pulse is present at V9 (b) grid, producing a white leading edge and black trailing edge on the color bars to check color fit. These various signals now present at plate, pin 6 of V9 (b) are coupled through condenser C43 to switch S3C.



In the dots position of switch S3 both 900 cycles and 189 kc signals from plate pin 1 and 6 of V9 (a) and (b) are connected through diode D2 and grid bias divider to grid pin 2 of V10 (a) 12AU7 video phase inverter, where they are mixed with the sync pulses. Because diode D2 and tube V10 (a) conduct only on the highest level which is at the crossover of the 900~ horizontal and 189 kc vertical bars, dots are produced. In the crosshatch position, diode D2 is removed from the circuit and condenser C42 and C43 are connected directly to the grid bias divider. In the horizontal bars position, only condenser C42 is connected, and in the vertical bars and the color bars position only condenser C43 is connected. In the shading bars position, both condenser C42 and C43 are connected again. Diode D3 in the grid bias divider clamps the 900-cycle and 189 kc pulses positively, but has little effect on the 3.564 signal, because resistor R49 is in series with the diode.

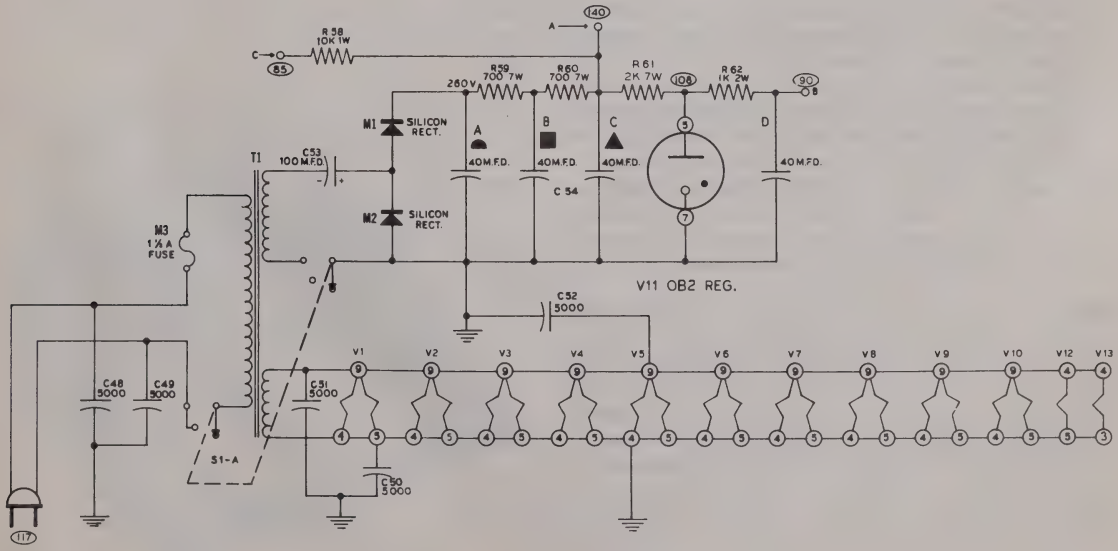
Either positive or negative-going signals may be selected from plate pin 1 of V10 (a), 12AU7 or cathode pin 3 by switch S4 and coupled by condenser C45 to grid pin 7 of V10 (b). Section (b) of V10 is a cathode follower providing low impedance video output.





V12 (b) 6BQ7 is a Colpitts oscillator that provides RF signals variable from 50 to 90 megacycles for the picture carrier. They are coupled from V12 (b) plate pin 1 through condenser C63 to the grid pin 1 of V13 6CS6 RF modulator and output. V12 (a) is a crystal-controlled oscillator using a 4.5 megacycle crystal in a Pierce oscillator circuit. This 4.5 megacycle signal is coupled from plate pin 6 of V12 (a) through condenser C62 to grid, pin 7 of V13, along with video information from V10 (b) that is coupled through condenser C65. The 4.5 mc signal modulates the picture carrier forming an unmodulated sound carrier 4.5 megacycles away from the picture carrier. The video information also appears on the picture carrier at the plate, pin 5 of V13, in the form of a modulated RF signal which is coupled to the RF output terminal.

B+ voltage for the Generator is developed using two silicon rectifiers in a half-wave voltage doubling circuit. It is adequately filtered at point A by condenser C54 A, B, and C, and resistors R59 and R60. Resistors R61 and R62 isolate V11 OB2 voltage regulator tube. Condenser C54D gives additional filtering at point B, which supplies all tubes in the divider chain with regulated B+ voltage for maximum stability.



CONSTRUCTION HINTS

This manual is supplied to assist you in every way to complete the instrument with the least possible chance for error. We suggest that you take a few minutes now and read the entire manual through before any work is started. This will enable you to proceed with the work much faster when construction is started. The large fold-in pictorials are handy to attach to the wall above your work space. Their use will greatly simplify the completion of the kit. These diagrams are repeated in smaller form within the manual. We suggest that you retain the manual in your files for future reference, both in the use of the instrument and for its maintenance.

UNPACK THE KIT CAREFULLY AND CHECK EACH PART AGAINST THE PARTS LIST. In so doing, you will become acquainted with the parts. Refer to the charts and other information shown on the inside covers of your manual to help you identify the components. If some shortage or parts damage is found in checking the Parts List, please read the REPLACEMENT section and supply the information called for therein.

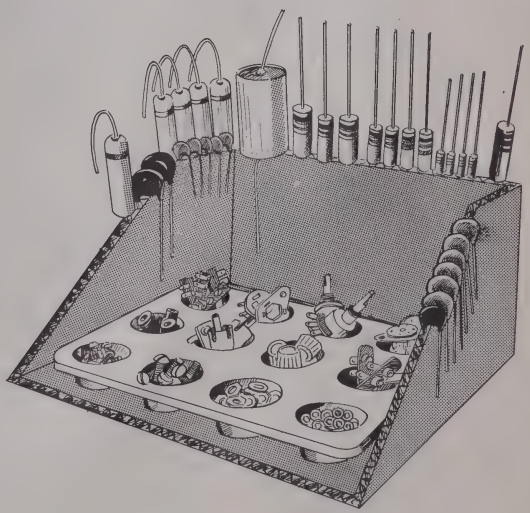
Resistors generally have a tolerance rating of ±10% unless otherwise stated in the Parts List. Therefore, a 100 KΩ resistor may test anywhere from 90 to 110 KΩ. (The letter K is commonly used to designate a multiplier of 1000.) Tolerances on condensers are generally even greater. Limits of +100% and -20% are common for electrolytic condensers. The parts furnished with your Heathkit have been specified so as to not adversely affect the operation of the finished instrument.

The abbreviation "NS" indicates that the connection should not be soldered as yet, for other wires will be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number appears after each solder (S) instruction. This number indicates the number of leads connected to the terminal in question. For example, if the instructions read, "Connect a 47 KΩ resistor from socket E1 (S-2)" it will be understood that there will be two leads connected to the terminal at the time it is soldered. This additional check will help avoid errors.

We suggest you do the following before work is started:

1. Attach the large fold-in pictorials to the wall above your work bench.
2. Go through the entire assembly and wiring instructions. This is an excellent time to read the entire construction section through and familiarize yourself with the procedure.
3. Lay out all parts so that they are readily available. Refer to the general information inside the front and back covers of this manual to help you identify components.

Most kit builders find it helpful to separate the various parts into convenient catagories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



NOTES ON ASSEMBLY AND WIRING

The Heathkit Color Bar and Dot generator when constructed in accordance with the instructions in the manual, is a high-quality crystal-controlled instrument capable of many years of trouble-free service. We, therefore, urge you to take the necessary time to read the manual and assemble and wire the kit carefully. Do not hurry the work and you will be rewarded with a greater sense of confidence both in your instrument and in your ability.

CAUTION: The variable condenser and the crystals are quite delicate and should be handled with care. The tuning condenser should be kept fully meshed until construction is completed to avoid bending the plates. The crystals can be damaged by a sharp blow of any kind, so they should be placed where they will not be disturbed or accidentally dropped.

Crimp all leads tightly to the terminal before soldering. Be sure both the lead and terminal are free of wax, corrosion or other foreign substances.

ROSIN CORE SOLDER HAS BEEN SUPPLIED WITH THIS KIT. THIS TYPE OF SOLDER MUST BE USED FOR ALL SOLDERING IN THIS KIT. ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE EQUIPMENT IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. IF ADDITIONAL SOLDER IS NEEDED, BE SURE TO PURCHASE ROSIN CORE (60:40 or 50:50 TIN-LEAD CONTENT) RADIO TYPE SOLDER.

Leads on resistors, capacitors and transformers are generally much longer than they need to be to make the indicated connections. In these cases, the excess leads should be cut off before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points. Not only does this make the wiring much neater but in many instances, the excessively long leads will actually interfere with proper operation of the instrument.

The pictorials indicate actual chassis wiring and designate values of the component parts. We very strongly urge that the chassis layout, lead placement and grounding connections be followed exactly as shown. While the arrangement shown is probably not the only satisfactory layout, it is the result of considerable experimentation and trial. If followed carefully, it will result in a stable instrument operating at a high degree of accuracy and dependability.

Space has been provided for you to check off each operation as it is completed. This is particularly important in wiring and it may prevent omissions or errors, especially where your work is interrupted frequently as the wiring progresses. Some kit builders have also found it helpful to mark each lead in colored pencil on the pictorial as it is added.

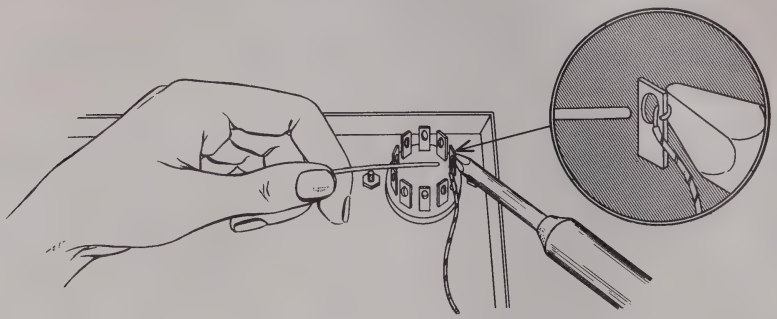
Unless otherwise indicated, all wire used is insulated. Wherever there is a possibility of the bare leads on resistors and capacitors shorting to other parts or to chassis, the leads should be covered with insulated sleeving. This is indicated in the instructions by the phrase "use sleeving." Bare wire is used where the lead lengths are short and the possibility of short circuits are non-existent.

PROPER SOLDERING PROCEDURE

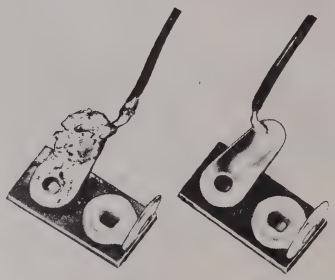
Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these, by far the largest proportion function improperly due to poor or improper soldering.

Correct soldering technique is extremely important. Good solder joints are essential if the performance engineered into the kit is to be fully realized. If you are a beginner with no experience in soldering, a half-hour's practice with odd lengths of wire and a tube socket will be a worthwhile investment.

If terminals are bright and clean and wires free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Crimp or otherwise secure the wire (or wires) to the terminal, so a good joint is made without relying on solder for physical strength. To make a good solder joint, the clean tip of the soldering iron should be placed against the joint to be soldered so that the terminal is heated sufficiently to melt solder. The solder is then placed against both the terminal and the tip of the iron and will immediately flow out over the joint. Refer to the sketch below. Use only enough solder to cover wires at the junction; it is not necessary to fill the entire hole in the terminal with solder. Excess solder may flow into tube socket contacts, ruining the socket, or it may creep into switch contacts and destroy their spring action. Position the work so that gravity tends to keep the solder where you want it.



A poor solder joint will usually be indicated by its appearance. The solder will stand up in a blob on top of the connection, with no evidence of flowing out caused by actual "wetting" of the contact. A crystalline or grainy texture on the solder surface, caused by movement of the joint before it solidified is another evidence of a "cold" connection. In either event, reheat the joint until the solder flows smoothly over the entire junction, cooling to a smooth, bright appearance. Photographs in the adjoining picture clearly indicate these two characteristics.



A good, clean, well-tinned soldering iron is also important to obtain consistently perfect connections. For most wiring, a 25 or 100 watt iron, or the equivalent in a soldering gun, is very satisfactory. Smaller irons generally will not heat the connections enough to flow the solder smoothly over the joint and are recommended only for light work, such as on etched circuit boards, etc. Keep the iron tip clean and bright. A pad of steel wool may be used to wipe the tip occasionally during use.

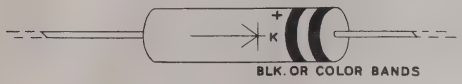
Take these precautions and use reasonable care during assembly of the kit. This will insure the wonderful satisfaction of having the instrument operate perfectly the first time it is turned on.

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

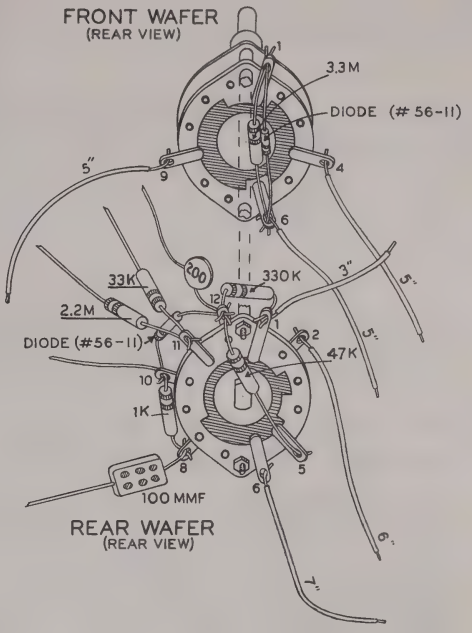
S3 SWITCH WIRING

( ) Locate the 2 wafer switch 63-133 and connect one lead of a 3.3 meg resistor (orange-orange-green) to lug 1 (NS) on rear of front wafer. Connect the other lead to lug 6 (NS).

( ) Locate the matched crystal diodes (#56-11). Connect the lead closest to the marking band or cathode of a crystal diode to lug 6 (NS). Connect the other lead to lug 1 (S-2). CAUTION: Do not overheat diodes. Use long nose pliers to hold lead when soldering.



ONE OR MORE OF THE ABOVE MARKINGS WILL APPEAR ON ALL TYPES OF CRYSTAL DIODES.



( ) Cut three 5" lengths of hookup wire and strip on both ends. Connect one wire to lug 4 (S) of front wafer.

( ) In like manner connect one wire to lug 6 (S-3) of front wafer.

( ) In like manner connect one wire to lug 9 (S) of front wafer.

( ) Connect the lead closest to the marking band or cathode of a crystal diode to lug 10 (NS) on rear wafer. Connect the other lead to lug 12 (NS) dress diode to front side of rear wafer.

( ) Connect one lead of a 1K resistor (brown-black-red) to lug 8 (NS) of rear wafer. Connect the other lead through lug 10 (S-2). CAUTION: Do not overheat diode while soldering. Leave excess lead on resistor.

( ) Connect one lead (with 1/2" length) of a 33K resistor (orange-orange-orange) to lug 11 (NS) of rear wafer.

( ) Connect one lead (with a 1/2" length) of a 2.2 megohm resistor (red-red-green) to lug 11 (S-2) of rear wafer.

( ) Connect one lead (with a 1/2" length) of a 100 $\mu\mu$fd mica condenser (brown-black-brown or .0001) to lug 8 (S-2) of rear wafer).

( ) Connect one lead of a 47K resistor (yellow-violet-orange) to lug 5 (S) of rear wafer. Connect the other lead to lug 12 (NS).

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to lug 1 (NS) of rear wafer. Connect other lead to lug 12 (NS).

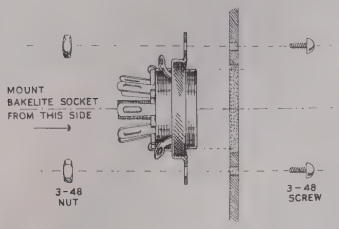
( ) Connect one lead (with a 3/4" length) of a 200 $\mu\mu$f ceramic disc condenser to lug 12 (S-4) of rear wafer. CAUTION: Do not overheat diode while soldering.

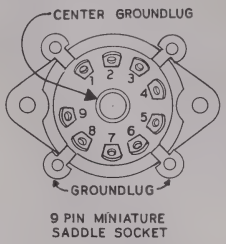
( ) Strip both ends of a 3" wire. Connect one end to lug 1 (S-2) of rear wafer.

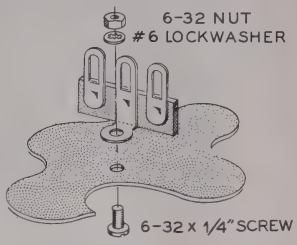
( ) Cut and strip on both ends a 6" length of hookup wire. Connect wire to lug 2 (S) on rear wafer.

( ) In like manner connect a 7" wire to lug 6 (S).

This completes the wiring of the switch. Check over connections to make sure all are soldered and set aside to be mounted on front panel later.







( ) Locate the small L-shaped RF sub-chassis and mount the 9-pin Bakelite tube socket (with ground lug in the middle) as shown in Figures 1 and 2. Use 3-48 hardware (NO lockwashers are used with 3-48 hardware.

( ) Mount the 4.5 megacycle crystal socket using 3-48 hardware.

( ) Mount the 3-lug terminal strips E and F using 6-32 hardware and lockwasher.

( ) Carefully bend lugs A and B at right angles to top of the tuning condenser and mount the condenser on RF's sub-chassis using short 6-32 screws with lockwashers. See Figure 1.

RF SUB-CHASSIS WIRING

( ) Connect a 2" bare wire from pin 3 of V12 (S) through the center ground lug (S) through pin 8 (S) through ground lug of tube socket (NS) and connect to lug 2 of terminal strip E (NS).

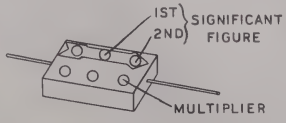
( ) Cut two 4" lengths of hookup wire, strip both ends and twist together. Connect one wire to V12 tube socket pin 4 (S). Connect the other wire to pin 5 (S).

( ) Connect one lead of a 2.2K resistor (red-red-red) through pin 2 (S) of V12, to tuning condenser lug D (NS). Feed the other lead through pin 9 (S) and connect to lug G (S-2).

( ) Connect one lead of a 150 $\mu\mu$fd mica condenser (brown-green-brown) to pin 1 (NS) of V12. Connect the other end to tuning condenser lug C (NS).

( ) Connect one lead of a 4.7 $\mu\mu$f ceramic condenser to tuning condenser lug C (S-2). Connect the other lead to tuning condenser lug D (S-2).

( ) Connect one lead of a 4.7 $\mu\mu$f ceramic condenser to pin 1 (NS) of V12 tube socket. Connect the other lead to lug 1 (NS) of terminal strip F.



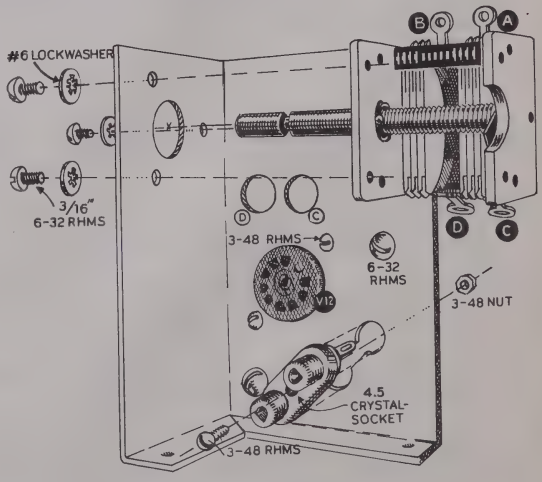


Figure 1

( ) Connect one lead of a 33K resistor (orange-orange-orange) to pin 1 (S-3) of the V12 socket. Connect the other lead to terminal strip E lug 1 (NS).

( ) Connect one lead of a 1000 $\mu\mu$fd ceramic disc condenser (.001 μfd) to lug 1 (NS) of terminal strip E. Connect the other lead to lug 2 (NS).

( ) Strip both ends of a 5 1/2" length of hookup wire. Connect one end to lug 1 (S-3) of terminal strip E.

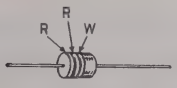
( ) Connect one lead of a 27 $\mu\mu$fd mica condenser (red-violet-black) through lug 1 (S) of 4.5 megacycle crystal socket to pin 7 (NS) of V12. Connect the other lead to ground lug 2 (S-3) of terminal strip E.

( ) Connect one lead of a 100K resistor (brown-black-yellow) to pin 7 (S-2) of V12. Connect the other lead to ground lug 2 (NS) of terminal strip F.

( ) Connect one lead of a 150 $\mu\mu$fd mica condenser (brown-green-brown) to lug 2 (S) of 4.5 megacycle crystal. Connect the other lead to pin 6 (NS) of V12.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to lug 3 (NS) of terminal strip F. Connect the other lead to pin 6 (NS) of V12.

( ) Connect one lead of a 2.2 $\mu\mu$fd GA ceramic condenser (red-red-white) to lug 3 (NS) of terminal strip E. Connect other lead to pin 6 (S-3) of V12 (use sleeving).



2.2 MMFD
G.A.TYPE COND.

( ) Connect one lead of a 1000 $\mu\mu$fd ceramic disc condenser (.001 μfd) to ground lug 2 (S-2) of terminal strip F. Connect the other lead to lug 3 (NS) of terminal strip F.

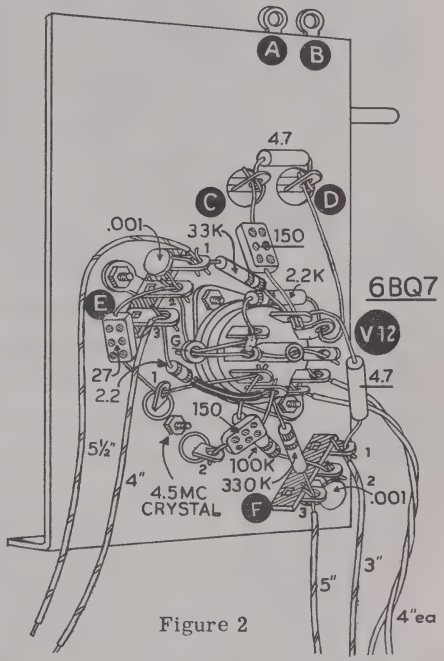


Figure 2

( ) Strip both ends of a 5" length of hookup wire. Connect one end to terminal lug 3 (S-3) of terminal strip F.

( ) Strip both ends of a 3" length of hookup wire. Connect one end to lug 1 (S-2) of terminal strip F.

( ) Strip both ends of a 4" length of hookup wire. Connect one end to lug 3 (S-2) of terminal strip E.

This completes RF sub-chassis wire. Check for loose solder connections and set aside to be mounted on main chassis later.

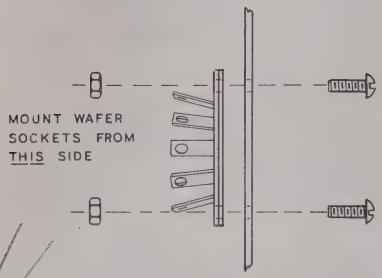
CRYSTAL SUB-CHASSIS ASSEMBLY

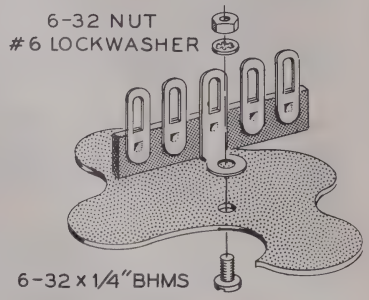
NOTE: When mounting wafer tube sockets, be sure to mount each socket from the bottom of the chassis. If, by mistake, the sockets are mounted so the lugs pass through the chassis, they will short to the chassis where they pass through the mounting hole.

( ) Mount the 9-pin wafer tube sockets V1, V2, and V6 with blank space towards bottom of chassis. Use 3-48 hardware.

( ) Mount the 189 kc and 3.564 megacycle crystal sockets using 3-48 hardware.

( ) Mount the 5-lug terminal strip H and the 3-lug terminal strip K using 6-32 hardware with lockwasher.





( ) Mount ground lugs J and L using 6-32 hardware.

( ) Mount the trimmer condenser C24 using 6-32 hardware.

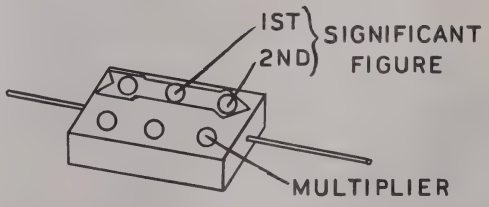
This completes the mechanical assembly. Make sure that mounting screws are tight.

CRYSTAL SUB-CHASSIS WIRING

( ) Connect a 2 1/2" length of bare wire from pin 3 (S) of 12AT7 V2 tube socket through pin 8 (S) to lug 2 (NS) of terminal strip K.

( ) In like manner connect a 2 1/2" length of bare wire to pin 3 (S) of V1 through pin 8 (S) to solder lug J (NS).

NUMBERING ON 9-PIN TUBE SOCKET



( ) In like manner connect a 2 1/2" length of bare wire from pin 3 (NS) of V6 through pin 8 (S) to ground lug L (NS).

( ) Connect one lead of 100 $\mu\mu$fd mica condenser (brown-black-brown or .0001 μfd) through pin 1 (NS) of V1 to lug 2 (S) of the 189 kc crystal socket. Connect the other lead to solder lug J (NS).

( ) Connect one lead of a 33K resistor (orange-orange-orange) to pin 2 (NS) of tube socket V2. Connect the other lead to lug 2 (S-2) of terminal strip K.

( ) Connect one lead of a 33K resistor to pin 1 (NS) of V2. Connect the other lead to lug 1 (NS) of terminal strip K.

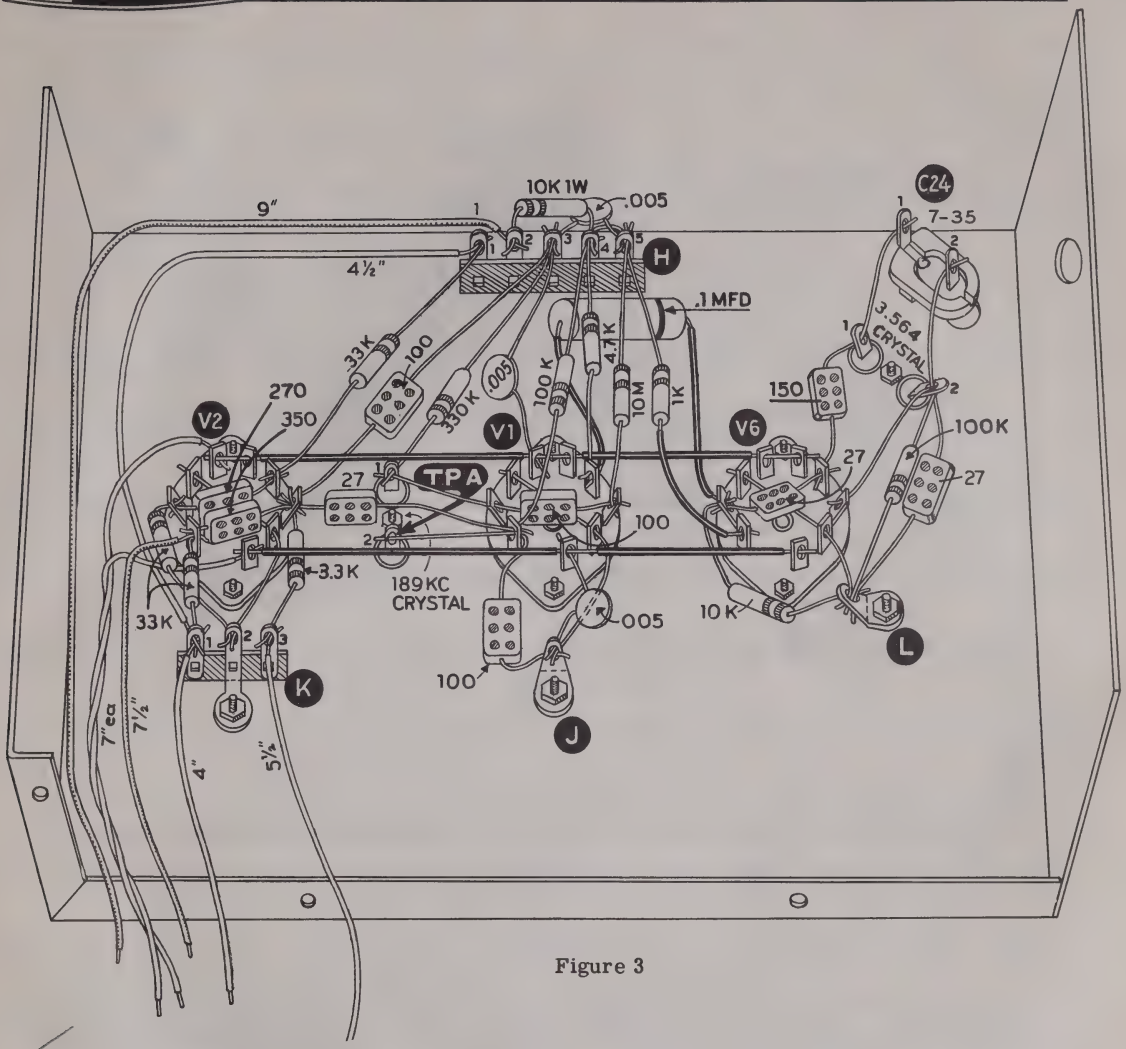


Figure 3

( ) Connect one lead of a 3.3K resistor (orange-orange-red) to pin 7 (NS) of V2. Connect the other lead to lug 3 (NS) of terminal strip K.

( ) Connect one lead of a 100 $\mu\mu$fd mica condenser (brown-black-brown) to pin 7 (NS) of V2. Connect the other lead to lug 3 (NS) of terminal strip H.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to lug 1 (NS) of the 189 kc socket. Connect the other lead to lug 3 (NS) of terminal strip H.

( ) Connect one lead of a 100 $\mu\mu$fd mica condenser (brown-black-brown) to pin 7 (NS) of V1 tube socket. Feed the other lead through pin 2 (S) and connect to lug 1 (S-2) of 189 kc crystal socket.

( ) Connect one lead of a 10K resistor (brown-black-orange) to pin 2 (NS) of tube socket V6. Connect the other lead to ground lug L (NS).

( ) Connect one lead of a 100K resistor (brown-black-yellow) to solder lug L (NS). Feed the other lead through lug 2 (NS) of 3.564 megacycle crystal socket and connect to pin 7 (S) of V6.

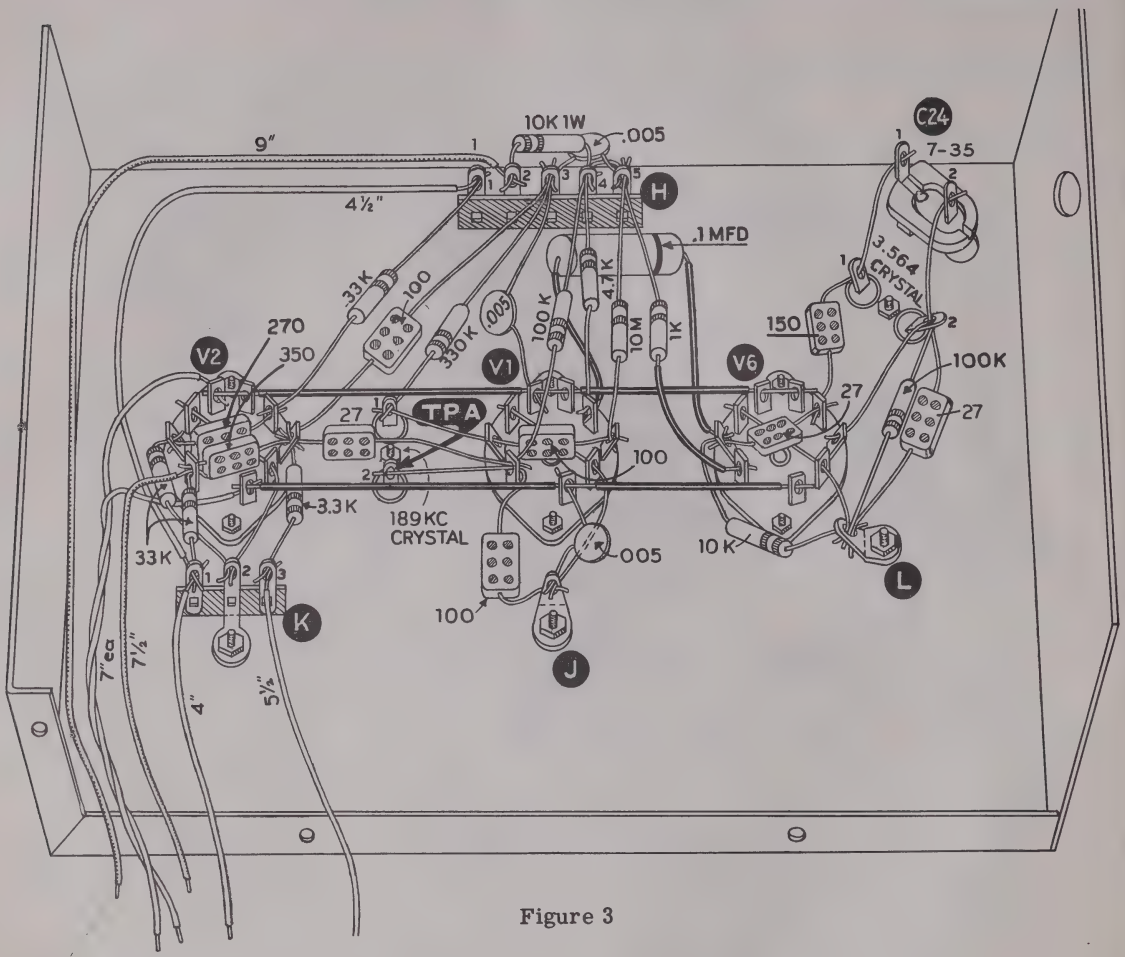


Figure 3

( ) Connect one lead of a 27 μμfd mica condenser (red-violet-black) to solder lug L (S-4). Feed the other lead through lug 2 (S-2) of 3.564 crystal socket and connect to lug 2 (S) of C24.

( ) Connect one lead of a 150 μμfd mica condenser (brown-green-brown) to pin 6 (NS) of tube socket V6. Feed the other lead through lug 1 (S) of 3.564 megacycle crystal socket and connect to lug 1 (S) of C24.

( ) Connect pin 9 (NS) of V2 and pin 9 of V1 (NS) and pin 9 (S) of V6 together with a 4" length of bare wire. Use sleeving. Twist the pins slightly so that wire may be fed from one socket to the other.

( ) In like manner connect pins 4 (NS) and 5 (S) of V2, pins 4 (NS) and 5 (S) of V1 and pins 4 (S) and 5 (S) of V6 together using a 4" length of bare wire with sleeving.

( ) Connect one lead of a .00035 μfd mica condenser (350 μμfd or orange-green-brown) to pin 1 (NS) of V2. Connect the other lead to pin 7 (NS).

( ) Connect one lead of .00027 μfd mica condenser (270 μμfd red-violet-brown) to pin 2 (S-2) of V2. Connect the other lead to pin 6 (NS).

( ) Connect one lead of a 33K resistor (orange-orange-orange) to pin 6 (S-2) of V2. Connect the other lead to lug 1 (NS) of terminal strip H.

( ) Connect one lead of 27 μμfd mica condenser (red-violet-black) to pin 7 (S-4) of V2. Connect the other lead to pin 1 (NS) on tube socket V1.

( ) Connect one lead of a .005 μfd ceramic disc condenser to pin 9 (S-2) of V1. Connect the other lead to solder lug J (S-3).

( ) Connect one lead of a .005 μfd ceramic disc condenser to pin 4 (S-2) of V1. Connect other lead to lug 3 (NS) of terminal strip H.

( ) Connect one lead of a .1 μfd tubular condenser to pin 6 (NS) of V1. Connect the other lead to pin 2 (NS) of V6. Use sleeving.

( ) Connect one lead of a 4.7K resistor (yellow-violet-red) to pin 6 (NS) of V1. Feed the other lead through lug 4 (NS) of terminal strip H and connect to lug 5 (NS).

( ) Connect one lead of a 1K resistor (brown-black-red) to pin 1 (NS) of V6. Use sleeving. Connect the other lead to lug 5 (NS) of terminal strip H.

( ) Connect one lead of a 10 megohm resistor (brown-black-blue) to pin 7 (NS) of V1. Connect the other lead to lug 5 (NS) of terminal strip H.

( ) Connect one lead of a 100K resistor (brown-black-yellow) to pin 1 (S-3) of tube socket V1. Connect the other lead to lug 4 (NS) of terminal strip H.

( ) Connect one lead of a .005 μfd ceramic disc condenser to lug 5 (NS) of terminal strip H. Connect the other lead to lug 3 (S-4).

( ) Connect one lead of a 1 watt 10K resistor (brown-black-orange) to lug 2 (NS) of terminal strip H. Connect the other lead to lug 4 (S-3).

( ) Connect one lead of a 27 μμfd mica condenser (red-violet-black) to pin 2 (S-3) of V6. Connect the other lead to pin 6 (NS) of tube socket V6.

( ) Strip both ends of a 4 1/2" length of hookup wire and connect one end to lug 1 (S-2) of terminal strip H. Connect the other end to lug 1 (NS) of terminal strip K.

( ) Strip two 7" lengths of hookup wire on both ends and twist together. Connect one wire to pin 4 (S-2) of V2. Connect the other wire to pin 9 (S-2) of V2. Dress wires to bottom of sub-chassis.

( ) Strip on both ends a 9 1/2" length of hookup wire. Connect one end to lug 2 (S-2) of terminal strip H. Dress wire towards the rear and bottom of sub-chassis.

( ) Strip a 7 1/2" length of hookup wire on both ends. Connect one end to pin 1 (S-3) of V2.

( ) Strip a 4" length of hookup wire on both ends. Connect one end to lug 1 (S-3) of terminal strip K.

( ) Strip a 5 1/2" length of hookup wire on both ends. Connect one end to lug 3 (S-2) of terminal strip K.

This completes the wiring of the crystal sub-chassis. Check over all wiring. All connections should be soldered with the exception of lug 5 of terminal strip H, pins 6 and 7 of tube socket V1, pins 1, 3 and 6 of tube socket V6. Shake out any loose wires or drops of solder and set aside to be mounted on the main chassis later.

MAIN CHASSIS ASSEMBLY

( ) Referring to Pictorial 1, insert the 3/8 rubber grommets P, O, HH, MM, QQ, and FF.

( ) Mount the 9-pin wafer tube sockets V3, V4, V5, V7, V8, V9, and V10 using 3-48 hardware. (No lockwashers are used with 3-48 hardware. Mount these sockets with the blank space towards rear of chassis.

( ) Mount the 7-pin tube socket V13 with the ground lug in the center with the blank space towards the side of chassis.

( ) In like manner mount the 7-pin tube socket V11.

( ) Mount ground lugs CC and JJ using 6-32 hardware.

( ) Mount the 2-lug terminal strip N, using 6-32 hardware with lockwashers. Position as shown in Pictorial 1.

( ) Mount the 3-lug terminal strip U.

( ) Mount the 5-lug terminal strip T.

( ) Mount the 4-lug terminal strip Y.

( ) Mount the 3-lug terminal strip DD and at the same time mount the C54 condenser mounting wafer.

( ) Mount the 5-lug terminal strip EE.

( ) Mount the 5-lug terminal strip LL.

( ) Mount the 3-lug terminal strip NN.

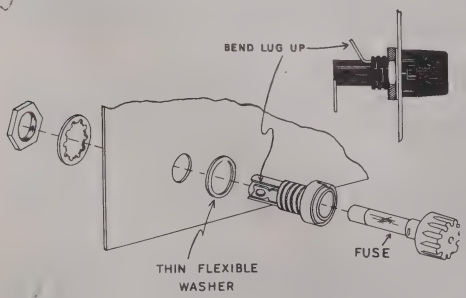
( ) Mount the 5-lug terminal strip UU.

( ) Mount the tab mount control R16 100K as shown in Figure 4. Twist the tab mounting in lugs 1/4 turn only.

( ) In like manner mount R34 10K, R6 10K, R22 250K, and R28 500K.

( ) Mount the fuse holder.

( ) Mount the 3-lug terminal strip BC.



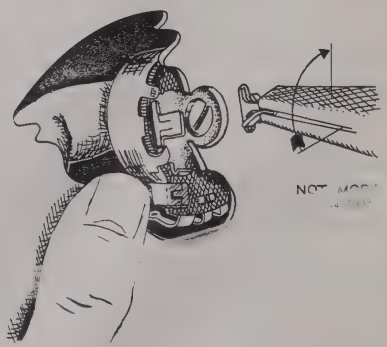
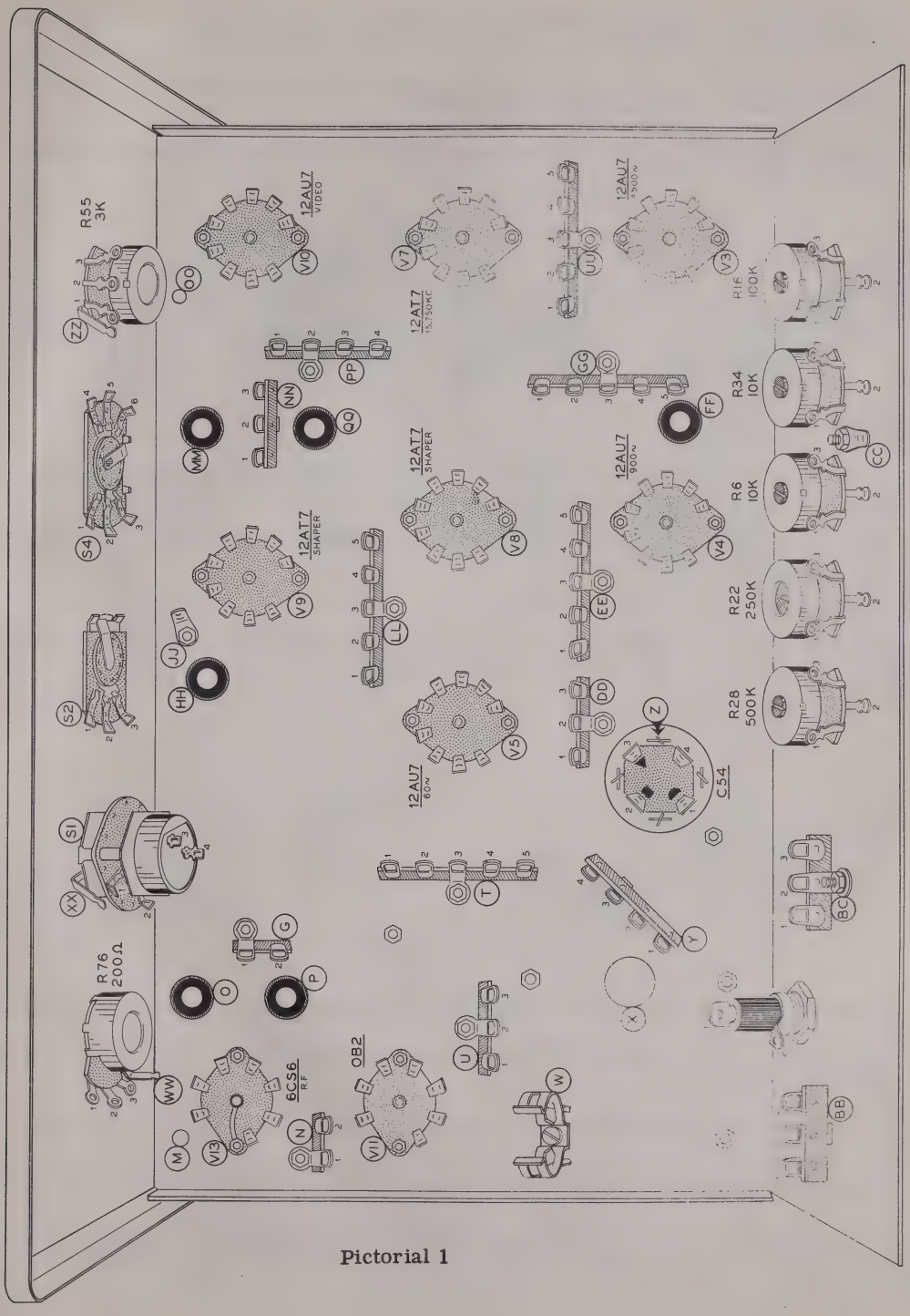


Figure 4

( ) Mount the 3-lug terminal strip BB. Use 6-32 hardware.

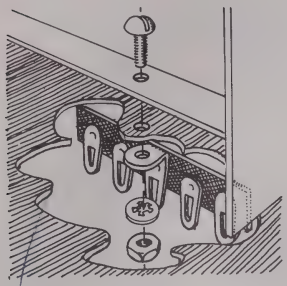

R55 3K
ZZ
S4
12AU7 VIDEO
V10
OO
12AT7 15,750KC
V7
UU
12AU7 1500~
V3
R16 100K
S2
S1
XX
R76 200Ω
WW
M
V13
6CS6 RF
N
O
G
P
OB2
V11
U
W
T
LL
V9
12AT7 SHAPER
JJ
HH
MM
NN
QQ
PP
12AT7 SHAPER
V8
12AU7 60~
V5
EE
DD
Z
C54
Y
X
BB
BC
12AU7 900~
V4
GG
FF
R28 500K
R22 250K
R6 10K
R34 10K
CC

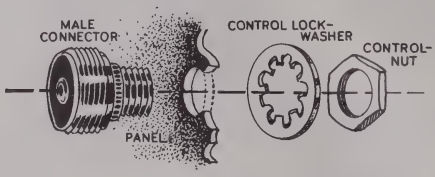
Pictorial 1

( ) Mount the power transformer using 8-32 hardware. At the same time mount the condenser clip W as shown in Pictorial 1, with the 8-32 nut on top of chassis.

( ) Mount the filter condenser C54 with the lug marked with moon-shape towards the silicon rectifier holder. Twist mounting lugs 1/8 turn.

( ) Mount the previously wired RF sub-chassis using 6-32 hardware. At the same time mount the 2-lug terminal strip G.





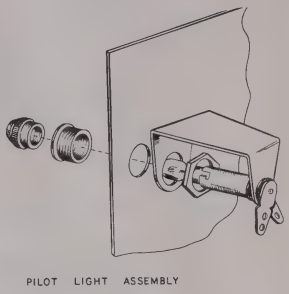


Figure 5

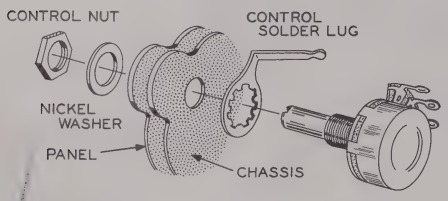
( ) In like manner mount the crystal sub-chassis and at the same time mount the 4-lug terminal strip PP and the 5-lug terminal strip GG.

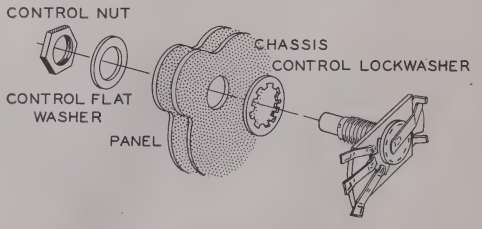
( ) Mount the video and RF output connection on the front panel as shown in Figure 5. Use a 3/8 control lockwasher under nut.

( ) Mount the pilot light socket as shown.

( ) Mount the front panel with switch S2. Use a control lockwasher under switch and nickel control washer on outside to protect panel as shown.

( ) In like manner mount switch S4.





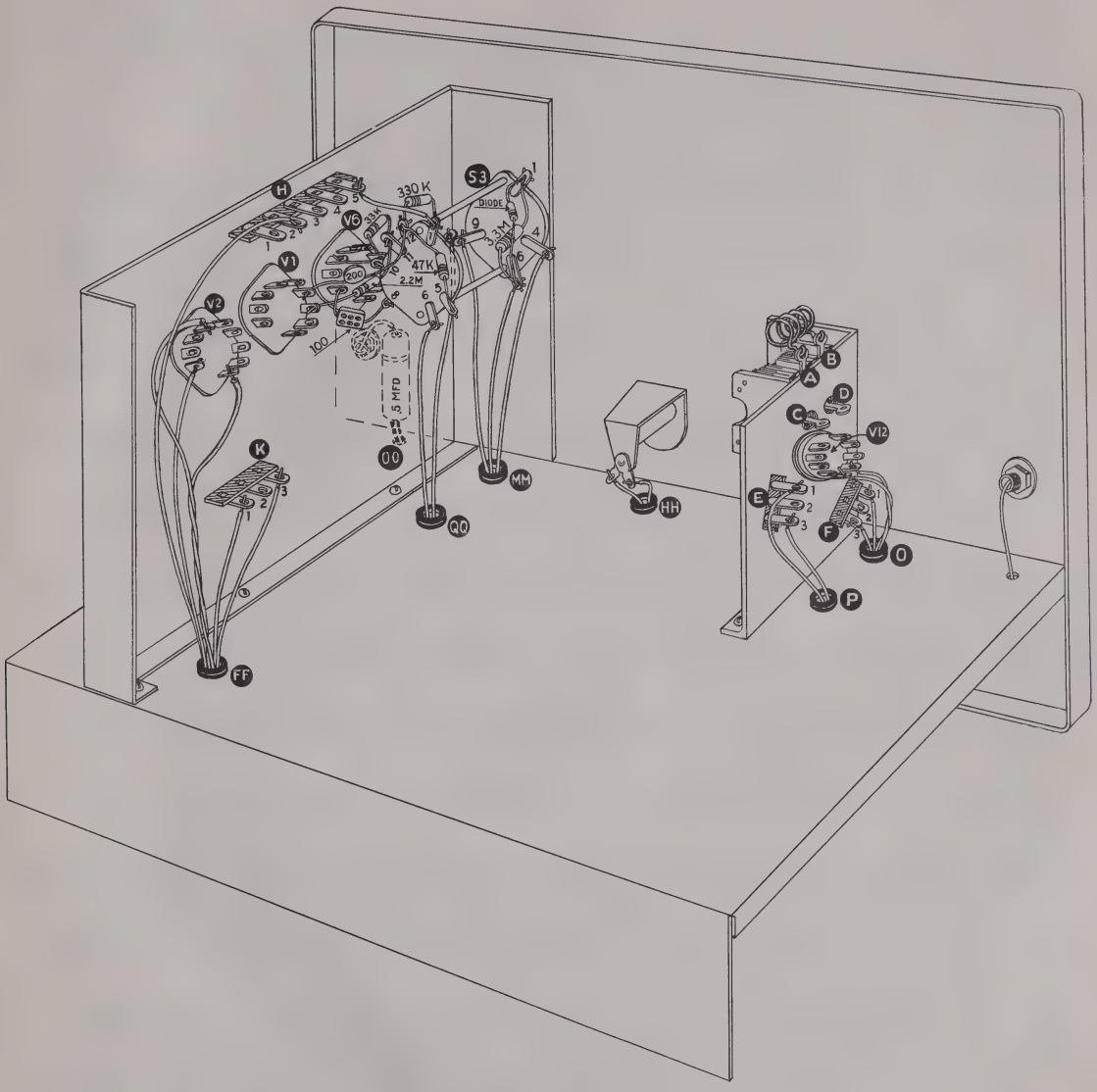
( ) Mount switch S1 using a control solder lug under switch, position as shown in Pictorial 1.

( ) Mount the RF output control R76 200Ω using a control solder lug and nickel washer. Position as shown in Pictorial 1.

( ) In like manner mount the video output control R55 3 KΩ, using a control solder lug.

( ) Turn the chassis over and mount the previously wired function switch S3 using a control lockwasher on inside and nickel control washer on outside of panel.

This concludes the mechanical mounting of the parts. Make sure that all mounting screws are tightened securely. With lockwashers under all 6-32 and 8-32 nuts. Then proceed as follows with the wiring.


H
V6
V1
V2
330K
S3
DIODE
3.3M
47K
2.2M
200
100
.5 MFD
K
00
MM
QQ
HH
FF
B
A
D
C
V12
E
F
O
P

Pictorial 2

MAIN CHASSIS WIRING (See Pictorial 3)

( ) Connect the short black wire of the power transformer to lug 2 (S) of fuse holder.

( ) Connect the short red wire from the transformer to lug 1 (NS) of terminal strip U.

( ) Connect the long red wire to lug 2 (S) of switch S1.

( ) Connect the long black wire to lug 4 (S) of switch S1.

( ) Connect one green filament wire through lug 3 (NS) of terminal strip T and connect to lug 2 (NS).

( ) In like manner connect the other green wire through lug 5 (NS) and connect to lug 4 (NS) of terminal strip T.

( ) Cut two 5" lengths of hookup wire and strip both ends, twist the wires together and connect one wire to lug 2 (NS) of terminal strip T. Connect the other wire to lug 4 (NS) of terminal strip T. Connect the other ends to pin 3 (NS) and pin 4 (NS) of tube socket V13.

( ) Feed the twisted filament wires from pins 4 and 5 of V12 on RF sub-chassis through grommet O. Connect one wire to pin 3 (S-2) and the other wire to pin 4 (S-2) of V13 tube socket.

( ) Feed the wire from lug 1 of terminal strip F on RF sub-chassis through grommet O and connect to pin 1 (NS) of V13.

( ) Feed the wire from lug 3 of terminal E on RF sub-chassis through grommet P and connect to pin 7 (NS) of V13.

( ) Feed the wire from lug 1 of terminal strip E on RF sub-chassis through grommet P and connect to lug 2 (NS) of terminal strip N.

( ) Feed the wire from lug 3 of terminal strip F on RF sub-chassis through grommet O and connect to lug 2 (S) of switch S2.

( ) Connect a 3" length of wire to pin 9 (NS) of V5. Connect other end to lug 5 (NS) of terminal strip T.

( ) Connect a 2 1/2" length of wire to lug 2 (S-3) of terminal strip T. Feed the other end through pin 4 (S) and connect to pin 5 (NS) of tube socket V5.

( ) Connect a 3" length of wire to pin 5 (S-2) of V5. Feed the other end through pin 4 (S) and connect to pin 5 (NS) of V8.

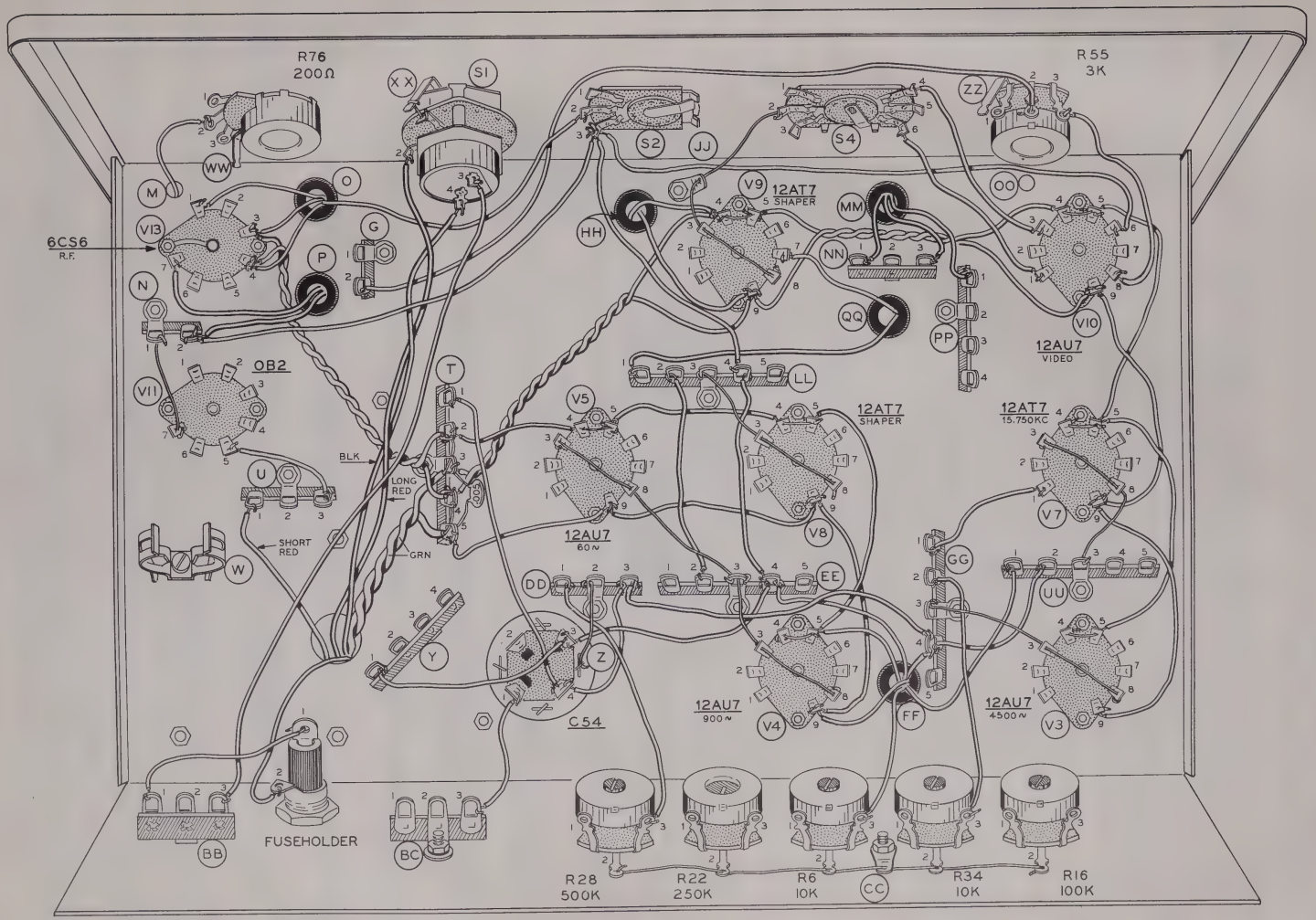
( ) Connect a 3" length of wire to pin 9 of V5 (S-2). Connect other end to pin 9 of V8 (NS).

( ) Connect a 3 1/2" length of wire to pin 9 (S-2) of V8. Connect the other end to pin 9 (NS) of V4.

( ) Connect a 4" wire to pin 5 (S-2) of V8. Feed the other end through pin 5 (NS) to pin 4 (S) of V4.

( ) Feed the two twisted wires from pin 4 and 9 of V2 on crystal sub-chassis through grommet FF. Connect one wire to pin 9 (S-2) and the other wire to pin 5 (S-2) of V4.

( ) Cut two 6 1/2" lengths of wire, strip both ends and twist together. Connect one wire to lug 3 (NS) and the other wire to lug 4 (S-3) of terminal strip T. Connect the other ends to pin 9 (NS) and pins 4 and 5 (NS) respectively of V9.


R76
200Ω
R55
3K
6CS6
R.F.
OB2
12AT7
5 SHAPER
12AU7
VIDEO
12AT7
SHAPER
12AT7
15.750KC
12AU7
60~
12AU7
900~
12AU7
4500~
C54
BLK
LONG
RED
SHORT
RED
GRN
FUSEHOLDER
R28
500K
R22
250K
R6
10K
R34
10K
R16
100K
S1
S2
S4
V3
V4
V5
V7
V8
V9
V10
V11
V13
W
Y
Z
BB
BC
CC
FF
GG
HH
JJ
LL
MM
NN
OO
PP
QQ
UU
ZZ

Pictorial 3

( ) Connect one lead of a 005 μfd ceramic condenser to lug 3 (S-3) of terminal strip T. Connect the other lead to lug 5 (S-3).

( ) Cut two 4" lengths of wire. Strip both ends and twist together. Connect one wire to pin 9 (NS) and connect the other wire to pin 4 (S-2) of V9 tube socket. Feed the two wires through grommet HH and solder one wire to each lug of pilot light socket.

( ) Cut two 5" lengths of wire. Strip both ends and twist together. Connect one wire to pin 9 (S-3) and the other wire to pin 5 (S-2) of tube socket V9. Connect the other ends of wires to pin 9 (NS) and pins 4 (S) and 5 (NS) of tube socket V10.

( ) Connect a 4 1/2" length of wire from pin 5 (S-2) of V10. Feed the other end of wire through pin 5 (NS) and connect to pin 4 (S) of tube socket V7.

( ) Connect a 4" length of wire to pin 9 (S-2) of V10. Connect the other end to pin 9 (NS) of V7.

( ) Connect a 4 1/2" length of wire to pin 5 (S-2) of V7. Feed the other end through pin 5 (S) and connect to pin 4 (S) of V3.

( ) Connect a 4" length of wire to pin 9 (S-2) of V7. Connect the other end to pin 9 (S) of V3.

( ) Feed the wire from lug 1 of terminal strip K on crystal sub-chassis through grommet FF and connect to lug 4 (NS) of terminal strip GG.

( ) In like manner connect the lead from lug 3 of terminal strip K to lug 3 (S) of control R6.

( ) Feed the wire from pin 1 of V2 on sub-chassis through grommet FF and connect to lug 1 (NS) of terminal strip UU.

( ) Feed the wire from lug 2 of terminal strip H on sub-chassis through grommet FF and connect to lug 4 (NS) of terminal strip EE.

( ) Feed the wire from lug 2 on the rear wafer of switch S3 through grommet QQ and connect to pin 7 (S) of V9.

( ) Feed the wire from lug 6 on rear wafer of switch S3 through grommet QQ and connect to lug 1 (NS) of terminal strip LL.

( ) Feed the wire from lug 9 on front wafer of switch S3 through grommet MM and connect to lug 1 (NS) of terminal NN.

( ) In like manner feed the wire from lug 4 through MM and connect to lug 3 (NS) of terminal strip NN.

( ) In like manner connect the wire from lug 6 on S3 to lug 1 of terminal strip PP (NS).

( ) With a 7" length of bare wire, tie all number 2 center lugs of R16 (S), R34 (S), R6 (S), R22 (S), and R28 (S) together and connect to solder lug CC (S). Twist center lugs slightly to feed through.

( ) Connect a 3" length of bare wire to lug 3 (NS) of terminal strip GG. Feed the other end through pin 3 (S) and connect to pin 8 (S) of V3.

( ) Connect a 2 1/2" length of hookup wire between lug 4 (NS) of terminal strip GG and lug 2 (NS) of terminal strip UU.

( ) Connect a 2 1/2" length of bare wire to lug 3 (NS) of terminal strip UU. Feed the other end of wire through pin 8 (S) and connect to pin 3 (S) of tube socket V7.

( ) Connect one end of a 2" length of hookup wire to pin 1 (NS) of V7. Connect the other end to lug 1 (NS) of terminal strip GG.

( ) Connect a 4" length of hookup wire between lug 2 (NS) of terminal strip GG and lug 3 (S) of control R34.

( ) Connect a 8" length of hookup wire to pin 6 (NS) of V10. Connect the other end to lug 3 (NS) of switch S2.

( ) Connect a 3 1/2" length of hookup wire between pin 8 (S) of V10 and lug 3 (S) of control R55.

( ) Connect a 3" length of wire between pin 1 (NS) of V10 and lug 6 (S) of switch S4.

( ) Connect a 3" length of wire to pin 3 (S) of V10 and lug 4 (NS) of switch S4.

( ) Connect one end of a 3" length of bare wire to pin 8 (S) of V9. Feed the other end through pin 3 (S) and solder lug JJ (S) and connect to lug 2 (S) of switch S4.

( ) Connect a 4" length of wire between lug 3 (NS) of switch S2 and lug 4 (NS) of terminal strip LL.

( ) Connect a 3" length of wire between lug 4 (NS) of terminal strip LL and lug 4 (NS) of terminal strip EE.

( ) Connect a 3" length of wire between lug 2 (NS) on terminal strip LL and lug 2 (NS) of terminal strip EE.

( ) Connect one end of a 2 1/2" length of bare wire to pin 8 (S) of V8. Feed the other end through pin 3 (NS) and connect to lug 3 (NS) of terminal strip LL.

( ) Connect a 3" length of hookup wire between lug 4 (NS) of terminal strip EE and lug 3 (NS) of filter condenser C54.

( ) Connect lug 4 (NS) of terminal strip GG and lug 3 (NS) of terminal strip DD together with a 4 1/2" length of hookup wire.

( ) Connect lug 3 (NS) of terminal strip EE and pin 3 (S) and pin 8 (NS) of V4 together with a 2 1/2" length of bare wire.

( ) Connect a bare wire from ground lug Z (S) of C54 to lug 2 (S) of terminal strip DD.

( ) Connect a 1-1/2" length of hookup wire between lug 3 (NS) of terminal strip BC and lug 1 (S) of filter condenser C54.

( ) Connect a 2 1/2" length of hookup wire between lug 4 (NS) of C54 and lug 3 (NS) of terminal strip DD.

( ) Connect a 4" length of wire between lug 4 (S-2) of C54 and lug 1 (NS) of terminal strip T.

( ) Connect a 2 1/2" length of wire between lug 3 (S-2) of C54 and lug 1 (NS) of terminal strip Y.

( ) Connect a 4" length of wire between lug 1 (NS) of terminal strip DD and lug 3 (S) of control R28.

( ) Connect a 3 1/2" length of bare wire to pin 3 (NS) of V5. Feed through pin 8 (NS) and connect to lug 3 (NS) of terminal strip EE.

( ) Connect a 6" length of hookup wire between lug 3 (S-3) of switch S-2 and lug 2 (NS) of terminal strip N.

( ) Connect a 9" length of hookup wire from lug 2 (NS) of terminal strip G to lug 2 (NS) of video level control R55.

( ) Connect a short bare wire to lug 1 of switch S1 (S) and wrap around control solder lug XX (S).

( ) Connect a 8 1/2" length of hookup wire between lug 3 (S) of switch S1 and lug 3 (NS) of terminal strip BB.

( ) Connect a 2" length of hookup wire between pin 5 (S) of V11 and lug 3 (NS) of terminal strip U

( ) Connect a 1 1/2" length of bare wire to lug 1 (NS) of terminal strip N. Connect the other end to pin 7 (S) of V11.

( ) Connect a 3" length of hookup wire between lug 2 (NS) of R76 and RF output jack (S) through hole M.

( ) Connect a 2 1/2" length of hookup wire between lug 1 (NS) of terminal strip BB and lug 1 (S) of fuse holder.

( ) Connect one lead of a 33K resistor (orange-orange-orange) to lug 4 (NS) of terminal strip GG. Connect the other end to pin 1 (NS) of tube socket V3.

( ) Connect one lead of a 27 $\mu\mu$fd mica condenser (red-violet-black) to pin 1 (NS) of V3. Connect the other end to lug 5 (NS) of terminal strip GG.

( ) Connect one lead of 68K (blue-gray-orange) to pin 7 (NS) of V3. Connect other lead to lug 3 (NS) of terminal strip UU.

( ) Connect a 47 $\mu\mu$fd ceramic disc condenser between pin 7 (NS) of V3 and lug 3 (NS) of terminal strip UU.

( ) In like manner connect a 27 $\mu\mu$fd mica condenser (red-violet-black) between pin 7 (NS) of V3 and lug 4 (NS) of terminal strip UU.

( ) Connect one lead of a 1000 $\mu\mu$fd mica condenser (brown-black-red or .001 μfd) to pin 7 (S-4) of V3. Connect the other end to pin 1 (S-3).

( ) In like manner connect another 1000 $\mu\mu$fd mica condenser between pin 6 (NS) and pin 2 (NS) of V3.

( ) Connect one lead of a 10K resistor (brown-black-orange) to pin 2 (S-2) of V3. Connect the other lead to lug 3 (S) of control R16. Use sleeving.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to lug 1 (NS) of terminal strip UU. Connect the other lead, using sleeving to lug 4 (S-2).

( ) Connect one lead of a 33K resistor (orange-orange-orange) to lug 2 (NS) of terminal strip UU. Connect the other lead to pin 6 (S-2) of V3.

( ) Connect one lead of a 33K resistor (orange-orange-orange) to lug 1 (NS) of terminal strip GG. Connect the other lead to lug 4 (NS).

( ) Connect one lead of a 10K resistor (brown-black-orange) to pin 2 (NS) of V7. Connect the other lead to lug 2 (S-2) of terminal strip GG.

( ) Connect one lead of a 150 $\mu\mu$fd mica condenser (brown-green-brown) to pin 7 (NS) of V7. Connect the other lead to lug 3 (NS) of terminal strip UU.

( ) Connect one lead of a 68K resistor (blue-gray-orange) between lug 3 (S-5) of terminal strip UU and pin 7 (NS) of V7.

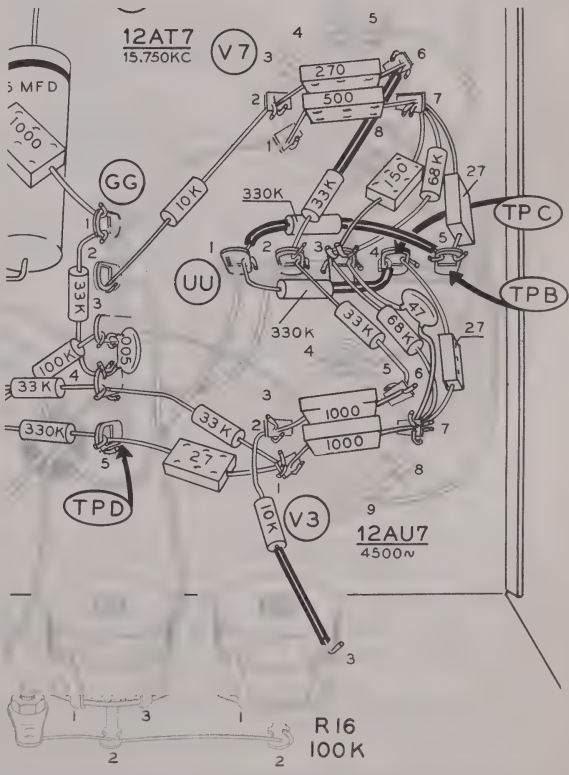
( ) Connect one lead of a 27 $\mu\mu$fd mica condenser (red-violet-black) to pin 7 (NS) of V7. Connect the other lead to lug 5 (NS) of terminal strip UU.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to lug 1 (S-3) of terminal strip UU. Use sleeving. Connect the other end to lug 5 (S-2).

( ) Using sleeving connect one lead of a 33K resistor (orange-orange-orange) to pin 6 (NS) of V7. Connect the other lead to lug 2 (S-3) of terminal strip UU.

( ) Connect one lead of a 500 $\mu\mu$fd mica condenser (green-black-brown or .0005) to pin 7 (S-4) of V7. Connect the other lead to pin 1 (S-2).

( ) Connect one lead of 270 $\mu\mu$fd mica condenser (red-violet-brown or .00027) to pin 6 (S-2) of V7. Connect the other lead to pin 2 (S-2).



( ) Connect one lead of a 3.3K resistor (orange-orange-red) to pin 1 (S-2) of V10. Connect the other lead to pin 6 (S-2).

( ) Using sleeving connect one lead of a .5 μfd condenser to pin 7 (NS) of V10. Connect the other lead to lug 5 (S) of switch S4.

( ) Connect one lead of a 47K resistor (yellow-violet-orange) to pin 2 (NS) of V10. Connect the other lead to lug 4 (NS) to terminal strip PP.

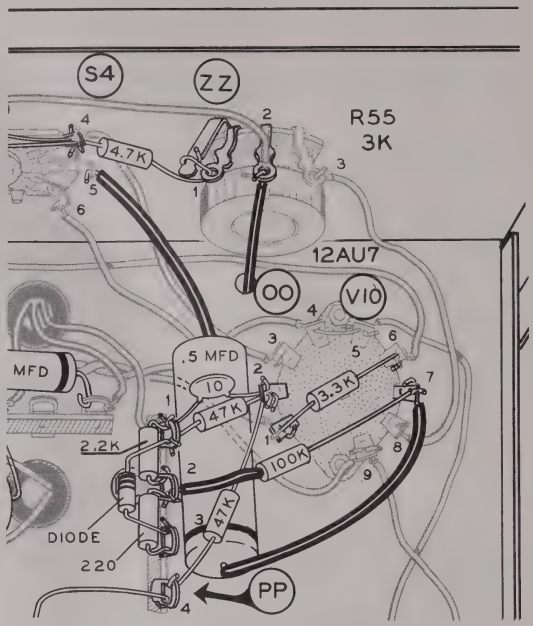
( ) Connect one lead of a 47K resistor to lug 1 (NS) of terminal strip PP. Connect the other lead to pin 2 (NS) of V10.

( ) In like manner connect a 10 μμfd ceramic disc condenser between lug 1 (NS) of terminal strip PP and Pin 2 (S-3) of V10.

( ) Connect one lead of a 100K resistor (brown-black-yellow) to pin 7 (S-2) of V10. Connect the other lead to lug 2 (NS) of terminal strip PP. Use sleeving.

( ) Connect one lead of a 2.2K resistor (red-red-red) to lug 1 (NS) of terminal strip PP. Connect the other lead to lug 2 (NS).

( ) Connect one lead of a 220Ω resistor (red-red-brown) to lug 2 (S-3) of terminal strip PP. Connect the other lead to lug 3 (NS).



( ) Connect the lead closest to the marking band or cathode of a crystal diode to lug 1 (S-5) of terminal strip PP. Connect the other lead to lug 3 (S-2). CAUTION: Do not overheat diode.

( ) Connect one lead of a 4.7K resistor (yellow-violet-red) to lug 4 (NS) of switch S4. Feed the other lead through lug 1 (S) of R55 control and wrap around control solder lug ZZ (S).

( ) Connect one lead of a 4.7K resistor to lug 1 (NS) of switch S4. Connect the other lead to lug 4 (NS).

( ) In like manner connect a 100 μμfd ceramic disc condenser between lug 1 (S-2) and lug 4 (S-4) of switch S4.

( ) Using sleeving insert one lead of a .5 μfd tubular condenser from top side of chassis through hole OO and connect to lug 2 (S-2) of R55 video level control. Connect the other lead to the video output jack (S). Use sleeving. See Page 36.

( ) Connect one lead of a .01 μfd tubular condenser to pin 6 (NS) of V9. Connect the other lead to lug 3 (S-2) of terminal strip NN.

( ) Connect one lead of .25 μfd tubular condenser to pin 1 (NS) of V9. Connect the other lead to lug 1 (S-2) of terminal strip NN.

( ) Connect one lead of a 4.7K resistor (yellow-violet-red) to pin 1 (S-2) of V9. Feed the other lead through lug 4 (NS) and connect to lug 5 (NS) of terminal strip LL.

( ) Connect one lead of a 10 meg resistor (brown-black-blue) to pin 2 (NS) of V9. Connect the other lead to lug 5 (NS) of terminal strip LL.

( ) Connect one lead of a 4.7K resistor (yellow-violet-red) to pin 6 (S-2) of V9. Connect the other lead to lug 5 (S-3) of terminal strip LL.

( ) Connect one lead of a 1 meg resistor (brown-black-green) to pin 2 (NS) of V9. Connect the other lead to lug 2 (NS) of terminal strip LL.

( ) In like manner connect a 47 $\mu\mu$fd ceramic disc condenser between pin 2 (NS) of V9 and lug 2 (NS) of terminal strip LL.

( ) Connect a 3.3 meg resistor (orange-orange-green) to pin 2 (S-4) of V9. Connect the other lead to lug 1 (S-2) of terminal strip LL.

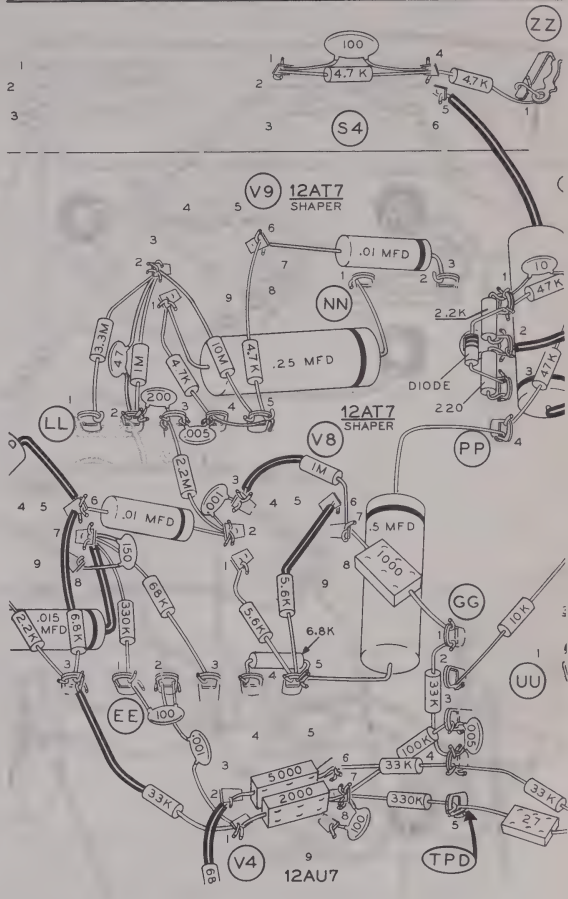
( ) Connect one lead of a 200 $\mu\mu$fd ceramic disc condenser to lug 2 (S-4) of terminal strip LL. Connect the other lead to lug 3 (NS).

( ) Connect one lead of a .005 μfd ceramic condenser to lug 3 (NS) of terminal strip LL. Connect the other lead to lug 4 (S-4).

( ) Connect one lead of a .01 μfd tubular condenser to pin 2 (NS) of V8. Connect the other lead to pin 6 (NS) of V5.

( ) Connect one lead of a 2.2 meg resistor (red-red-green) to pin 2 (NS) of V8. Connect the other lead to lug 3 (S-4) of Terminal strip LL.

( ) Connect one lead of a .001 μfd ceramic disc condenser to pin 2 (S-3) of V8. Connect the other lead to pin 3 (NS).



( ) Connect one lead of a 1 megohm resistor (brown-black-green) to pin 3 (S-3) of V8 using sleeving. Connect the other lead to pin 7 (NS).

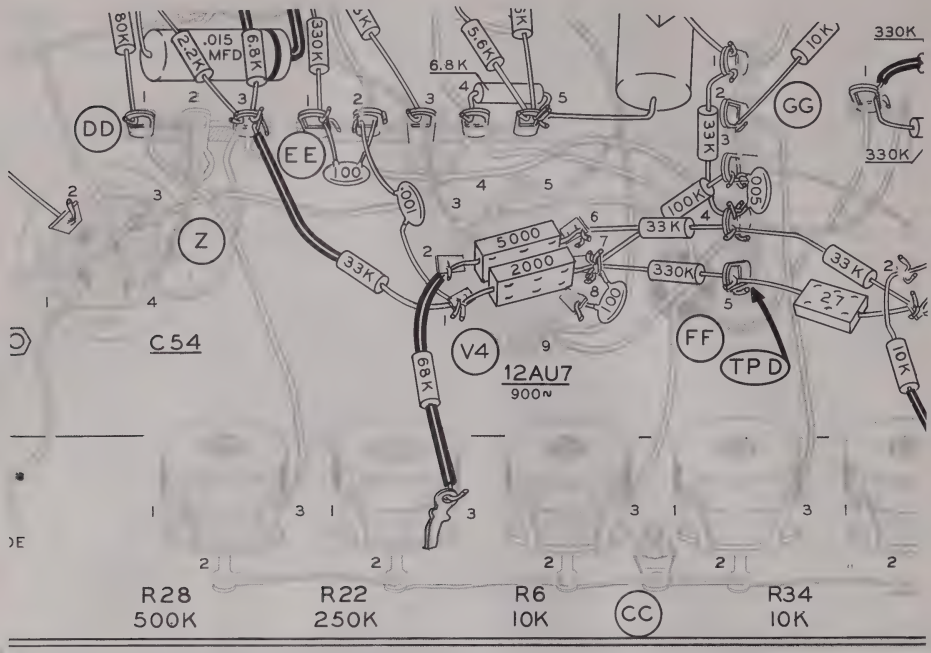
( ) Connect one lead of a 6.8K resistor (blue-gray-red) to lug 4 (S-4) of terminal strip EE. Connect the other lead to lug 5 (NS).

( ) Connect one lead of a 5.6K resistor (green-blue-red) to lug 5 (NS) of terminal strip EE. Connect other lead to pin 1 (S) of V8.

( ) In like manner connect a 5.6K resistor between lug 5 (NS) of terminal strip EE and pin 6 (S) of V8. Use sleeving.

( ) Connect one lead of a .5 μfd tubular condenser to lug 5 (S-4) of terminal strip EE. Connect other other lead to lug 4 (S-2) of terminal strip PP.

( ) Connect one lead of a 1000 $\mu\mu$fd mica condenser (brown-black-red or .001 μfd) to pin 7 (S-2) of V8. Connect the other lead to lug 1 (S-3) of terminal strip GG.



( ) Connect one lead of a 100K resistor (brown-black-yellow) to pin 7 (NS) of V4. Connect the other lead to lug 3 (NS) of terminal strip GG.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to pin 7 (NS) of V4. Connect the other lead to lug 5 (S-2) of terminal strip GG.

( ) Connect one lead of a .005 μfd ceramic condenser to lug 3 (S-3) of terminal strip GG. Connect the other lead to lug 4 (NS).

( ) Connect one lead of a 100 μμfd ceramic disc condenser to pin 7 (NS) of V4. Connect the other lead to pin 8 (S-2).

( ) Connect one lead of a 33K resistor (orange-orange-orange) to lug 3 (NS) of terminal strip DD. Use sleeving. Connect the other lead to pin 1 (NS) of V4.

( ) Connect one lead of a 100 μμfd ceramic disc condenser to lug 1 (NS) of terminal strip EE. Connect the other lead to lug 2 (NS).

( ) Connect one lead of a .001 μfd ceramic disc condenser (1000 μμfd) to lug 2 (S-3) of terminal strip EE. Connect the other lead to pin 1 (NS) of V4.

( ) Connect one lead of a .002 mica condenser (red-black-red or 2000 μμfd) to pin 1 (S-3) of V4. Connect the other lead to pin 7 (S-4).

( ) Connect one lead, using sleeving, of a 68K resistor (blue-gray-orange) to pin 2 (NS) of V4. Connect the other lead to lug 3 (S) of control R22.

( ) Connect one lead of a 33K resistor (orange-orange-orange) to pin 6 (NS) of V4. Connect the other lead to lug 4 (S-7) of terminal strip GG.

( ) Connect one lead of a 5000 μμfd silver mica condenser (green-black-red) or .005 μfd to pin 2 (S-2) of V4. Connect the other lead to pin 6 (S-2).

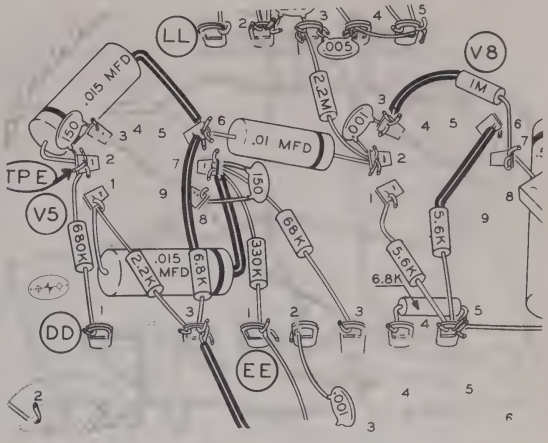
( ) Connect one lead of a 68 K resistor (blue-gray-orange) to pin 7 (NS) of V5. Connect the other lead to lug 3 (S-3) of terminal strip EE.

( ) Connect one lead of a .015 μfd tubular condenser to pin 1 (NS) of V5. Using sleeving connect the other lead to pin 7 (NS).

( ) In like manner connect .015 μfd tubular condenser between pin 2 (NS) and pin 6 (NS) of V5. Use sleeving.

( ) Connect one lead of a 330K resistor (orange-orange-yellow) to pin 7 (NS) of V5. Connect the other lead to lug 1 (S-2) of terminal strip EE.

( ) Connect one lead of a 150 μμfd ceramic disc condenser to pin 7 (S-4) of V5. Connect other lead to pin 8 (S-2).



( ) Connect one lead of a 150 μμfd ceramic disc condenser to pin 2 (NS) of V5. Connect the other lead to pin 3 (S-2).

( ) Connect one lead of a 680K resistor (blue-gray-yellow) to pin 2 (S-3) of V5. Connect the other lead to lug 1 (S-2) of terminal strip DD.

( ) Connect one lead of a 2.2K resistor (red-red-red) to pin 1 (S-2) of V5. Connect the other lead to lug 3 (NS) of terminal strip DD.

( ) Connect one lead of a 6.8K resistor (blue-gray-red) to pin 6 (S-3) of V5. Use sleeving. Connect the other lead to lug 3 (S-5) of terminal strip DD.

( ) Connect one lead of a 220Ω resistor (red-red-brown) to lug 1 (NS) of R76. RF level control. Feed the other lead through lug 3 (NS) wrap around control solder lug (S) and connect to pin 2 (NS) of V13.

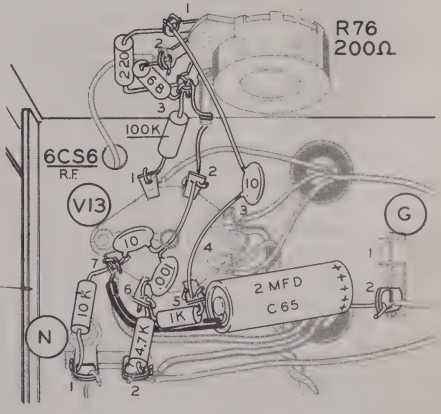
( ) Connect one lead of a 100K resistor (brown-black-yellow) to pin 1 (S-2) of V13. Connect the other lead to lug 3 (NS) of R76.

( ) Connect one lead of a 68Ω resistor (blue-gray-black) to lug 2 (S-2) of R76. Connect the other lead to lug 3 (S-3).

( ) Connect one lead of a 4.7K resistor (yellow-violet-red to pin 6 (NS) of V13. Connect the other lead to lug 2 (S-3) of terminal strip N.

( ) Connect one lead of a 1K resistor (brown-black-red) to pin 5 (NS) of V13. Connect the other lead to pin 6 (NS).

( ) Connect one lead of a 10K resistor (brown-black-orange) to pin 7 (NS) of V13. Connect the other lead to lug 1 (S-2) of terminal strip N.



( ) Connect the negative lead of condenser C65 2 μfd to pin 7 (NS) of V13. Use sleeving. Connect the positive lead to lug 2 (S-2) of terminal strip G.

( ) Connect one lead of a 10 μμfd ceramic disc condenser to pin 7 (S-4) of V13. Feed the other lead through the center ground lug (NS) of V13 socket and connect to pin 2 (S-2).

( ) Connect one lead of a .001 μfd ceramic disc condenser to pin 6 (S-3) of V13 connect the other lead to the center ground lug (S-2).

( ) Connect one lead of a 10 μμfd ceramic disc condenser to pin 5 (S-2) of V13. Connect the other lead to lug 1 (S-2) of R76.

(√) Connect one lead of a 1K 2-watt resistor (brown-black-red) to lug 3 (NS) of terminal strip U. Connect the other lead to lug 1 (S-2) of terminal strip T.

(√) Connect one lead of a 2K 7-watt wire-wound resistor (may be 7-watt) to lug 3 (S-3) of terminal strip U. Connect the other lead to lug 1 (NS) of terminal strip Y. (Dress resistor away from transformer wires.)

(√) Connect one lead of a 700Ω 7-watt wire-wound resistor to lug 1 (S-3) of terminal strip Y. Connect the other lead to lug 4 (NS).

(√) Connect one lead of a 700 Ω 7-watt wire-wound resistor to lug 3 (NS) of terminal strip BC. Feed the other lead through lug 4 of terminal strip Y (S-3) and connect to lug 2 (S) of condenser C54.

(√) Mount condenser C53 100 μfd in holder W with positive end toward rear of chassis. Connect the positive lead to lug 1 (NS) of terminal strip BC. Use sleeving. Connect the negative lead to lug 1 (S-2) of terminal strip U.

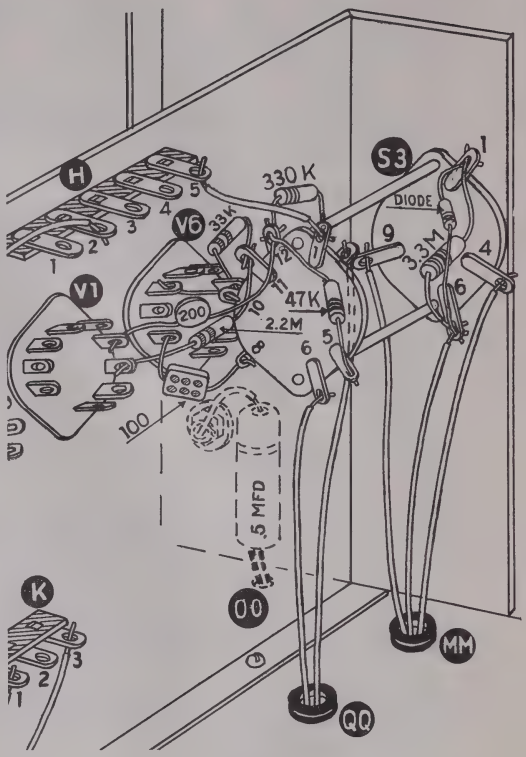
(√) Connect a silicon diode between lugs 1 (NS) and 2 (S-1) of terminal strip BC. Connect the lead at the marked end to lug 1.

(√) Connect a silicon diode between lugs 1 (S-3) and 3 (S-3) of terminal strip BC. Connect the lead at the marked end to lug 3.

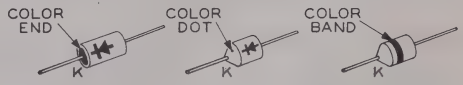
(√) Insert the line cord through hole AA. Connect one wire to lug 1 (NS) of terminal strip BB. Connect the other wire to lug 3 (NS).

(√) Install the line cord strain relief. See Detail 4A.

(√) Connect the one lead of a .005 μfd ceramic disc condenser to lug 1 (S-3) of terminal strip BB. Connect the other lead to lug 2 (NS).



NOTE: WHEN INSTALLING SILICON DIODES, THE CATHODE END SHOULD BE PLACED AS DIRECTED. THE CATHODE END IS MARKED WITH EITHER COLOR END, COLOR DOT, OR COLOR BAND. IN THE ILLUSTRATION, THE SYMBOL K INDICATES THE CATHODE END.



(√) Connect one lead of a .005 ceramic disc condenser to lug 2 (S-2) of terminal strip BB. Connect the other lead to lug 3 (S-3).

(√) Turn the chassis over and connect the 100 μμfd mica condenser from lug 8 of switch S3 to pin 1 (S-2) of V6.

(√) Connect the bare wire from lug 10 of S3 to pin 3 (S-2) of V6.

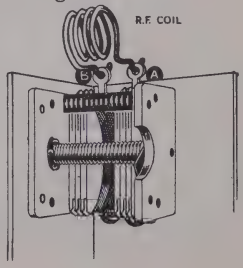
(√) Connect the 2.2 meg resistor (red-red-green) to pin 7 (S-3) of V1.

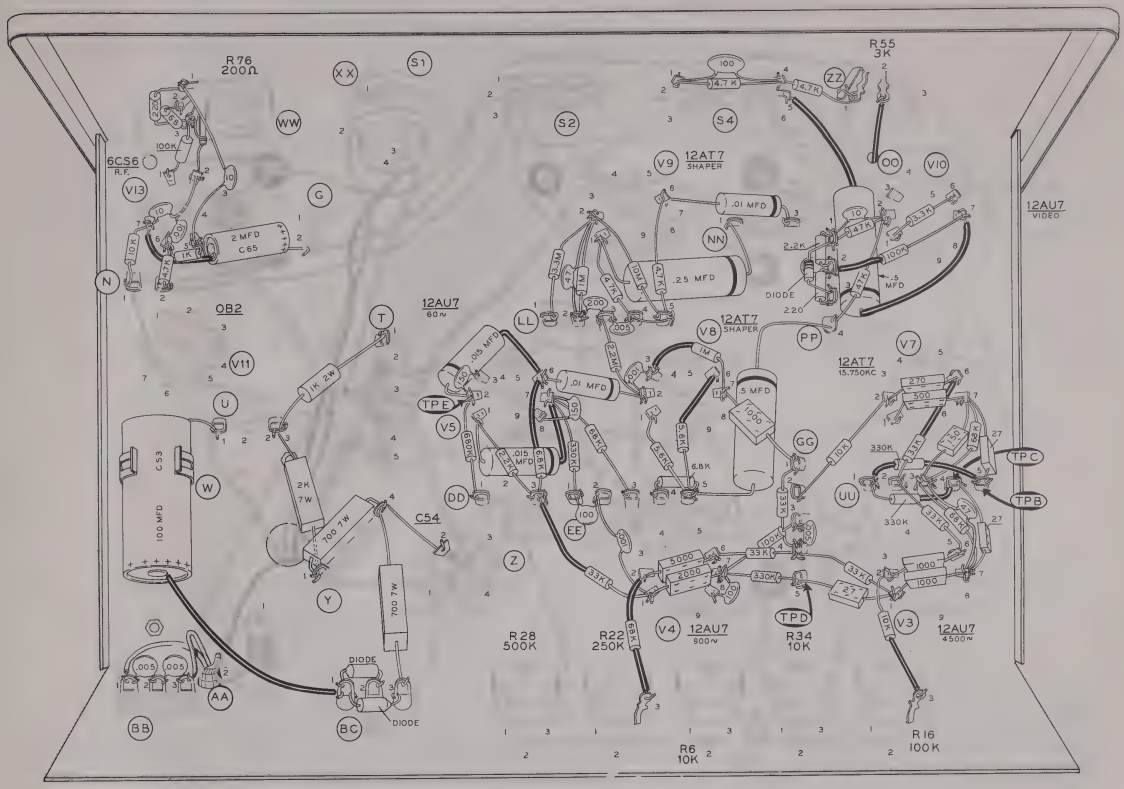
(√) Connect the 33 K resistor (orange-orange-orange) to pin 6 (S-3) of V6.

(√) Connect the 200 μμfd ceramic condenser to pin 6 (S-3) of V1.

(√) Connect the lead from lug 1 of S3 to lug 5 (S-5) of terminal strip H.

(√) Mount the RF coil at A (S) and B (S) of tuning condenser. Dress at a 45-degree angle to condenser lugs.

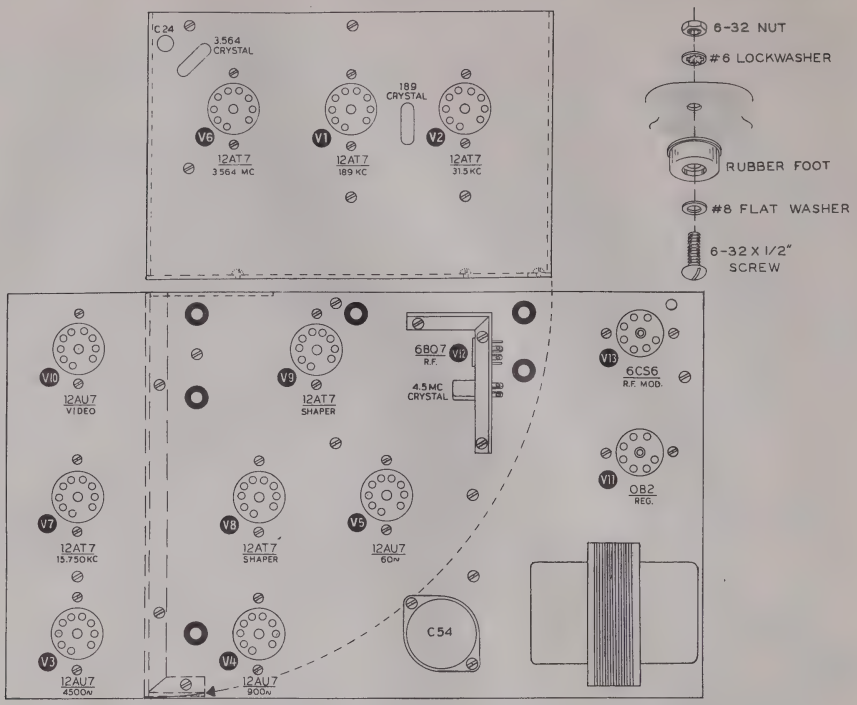




Pictorial 4

Detail 4A

PICTORIAL 5



This completes the wiring of your Heathkit Color Bar and Dot Generator. Carefully recheck each operation for accuracy. Remove any solder splashes, wire clippings, or any foreign material. Inspect the wiring to be sure all components are dressed to avoid shorts to each other or to the chassis.

( ) Insert the 1-1/2 amp fuse.

Refer to Detail 5A when installing the knobs.

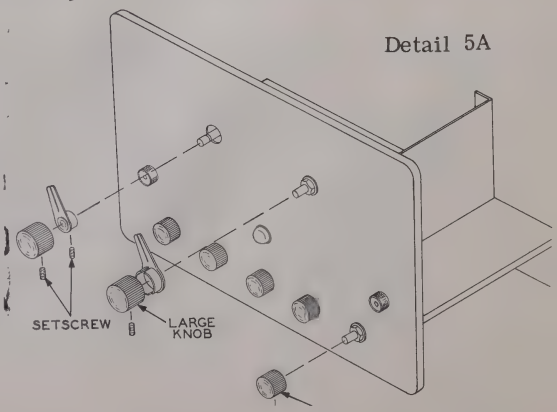
( ) Install the channel pointer assembly on the tuning condenser shaft, using an 8-32 setscrew. Align the pointer at 1/4" from the channel 2 end of the scale with the condenser shaft turned fully counterclockwise. Then tighten the setscrew in the pointer assembly.

( ) Install a large knob on the protruding channel tuning shaft and tighten the setscrew.

( ) Press the long pointer into the remaining large knob. The pointer should point away from the knob setscrew hole. Install this knob assembly on the selector shaft and tighten the setscrew.

( ) Install the small knobs on the remaining front panel control shafts. Align the pointers at the left-hand panel markings with the control shafts fully counterclockwise. Tighten the setscrews.

Detail 5A



( ) Install the #47 pilot light.

( ) Insert the three crystals in their proper sockets.

( ) Insert all the tubes in their proper sockets. Refer to Pictorial 5.

( ) Install the handle on the instrument cabinet using #10 sheet metal screws.

( ) Install the four rubber feet in the bottom of the cabinet using 6-32 x 1/2" screws, #8 flat washers, #6 lockwashers and 6-32 nuts.

NOTE: The blue and white identification label shows the Model Number and Productions Series Number of your kit. Refer to these numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

( ) Install the identification label in the following manner:

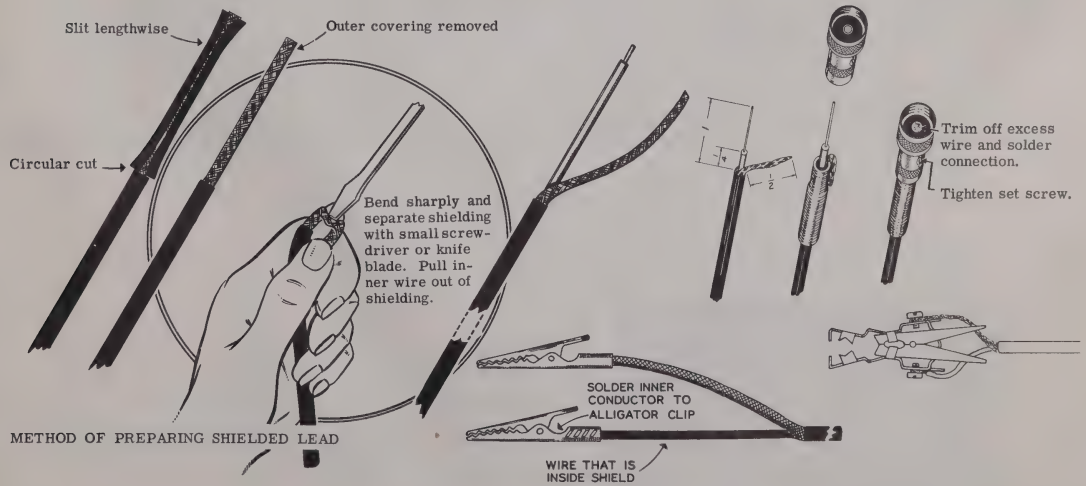
1. Select a location for the label where it can easily be seen when needed, but will not show when the unit is in operation. This location might be on the rear panel or the top of the chassis, or on the rear or bottom of the cabinet.

2. Carefully peel away the backing paper. Then press the label into position.

WIRING OF TEST LEAD

( ) Cut away 3" of the outer insulation of the coaxial cable. Double the lead over and pull the center conductor through the side of the braid as shown in the Figure below. Strip off 1/4" of insulation from the center conductors. Install either the clothespin-type antenna clip or the alligator clips, whichever will be the most convenient for you to use.

( ) Prepare the opposite end of the cable by cutting off 1" of outer insulation and pulling the center conductor through the braid. Remove the spring from the coaxial connector and slip the large end over the insulation. Bend the braid back over the small end of the spring. Strip about 3/4" of the insulation from the center wire, and push it through the center hole of the connector. Tighten the set screw to hold the spring and braid in place and solder the center connector. Cut off any excess braid.


Slit lengthwise
Outer covering removed
Circular cut
Bend sharply and separate shielding with small screwdriver or knife blade. Pull inner wire out of shielding.
METHOD OF PREPARING SHIELDED LEAD
1/2
Trim off excess wire and solder connection.
Tighten set screw.
SOLDER INNER CONDUCTOR TO ALLIGATOR CLIP
WIRE THAT IS INSIDE SHIELD

TESTING THE COMPLETED INSTRUMENT

If an ohmmeter is available, check the DC resistance between lug 3 of terminal strip BC and ground. The resistance should be at least 20,000 ohms after one minute. If lower, carefully recheck wiring for an error by tracing each wire with a red pencil.

Connect the line cord to a 105 to 125 volt, 50-60 cycle, AC outlet. DO NOT CONNECT THIS INSTRUMENT TO A DC (DIRECT CURRENT) LINE OR SERIOUS DAMAGE TO THE POWER TRANSFORMER WILL RESULT. Do not attempt to use this instrument on a 25-cycle AC source, for it will not operate and the transformer may be damaged.

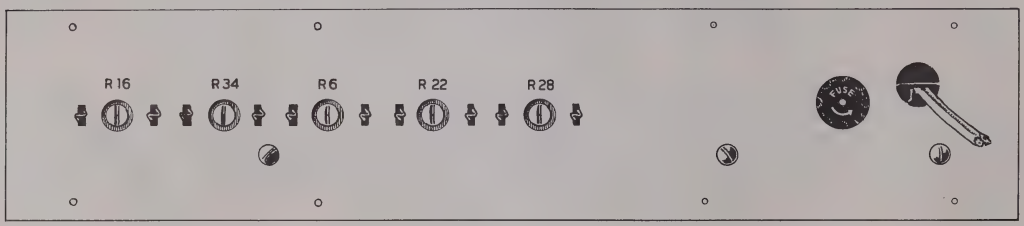
Turn the instrument on by rotating the S1 switch to the standby position. The filaments of all the tubes should light. Turn the switch S1 to the "ON" position. A blown fuse indicates the existence of a short circuit somewhere and further checks will be necessary to locate the trouble.

ALIGNMENT AND SETUP PROCEDURES

Adjustments of Divider Chain Multivibrators:

These adjustments require the use of a good cathode ray oscilloscope, such as one of the Heathkits models which were used for the accompanying illustrations. (Also see alternate method).

A 10 $\mu\mu$fd condenser is supplied in the kit to be used in series with the direct probe of the oscilloscope to prevent loading of the circuit. Test points and control locations are indicated on the schematic and pictorial diagrams.



Turn on the Generator and allow ten minutes warmup time. Adjust R6, R34, R16, R22, and R28 to the center of their range, then proceed as follows:

STEP	CONNECT VERTICAL INPUT OF OSCILLOSCOPE THROUGH 10$\mu\mu$FD CONDENSER TO:	ADJUST	FOR FIG.
1	Test point A (TPA)	R6 31.5 kc	A-1 step of 6
2	Test point B	R34 15.750 kc	B step of 2
3	Test point C	R16 4500~	C step of 7
4	Test point D	R22 900~	D step of 5
5	* Test point E	R28 60~	E step of 15

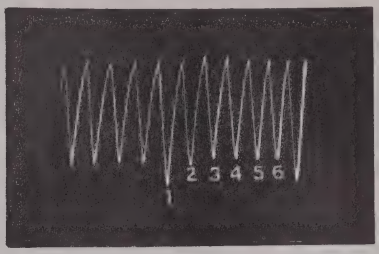
(See Pictorials on Page 20 and 37 for test point location)

*See note on page 42.

Note: Make sure the controls are in the center of their lock-in range by rotating the control back and forth.

Figure A-1 -- 31.5 kc R6 adjusted correctly. Oscilloscope horizontal speed 1/2 31.5 kc or 15.750

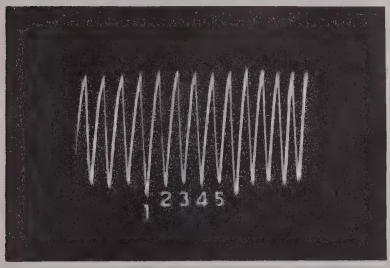
189 kc divided by 6 equals 31.5 kc.



Counting from left to right, start with first long pulse counting it as #1. Adjust R6 until 6 pulses are present before the next long pulse, or in other words, 5 small pulses between the long pulses.

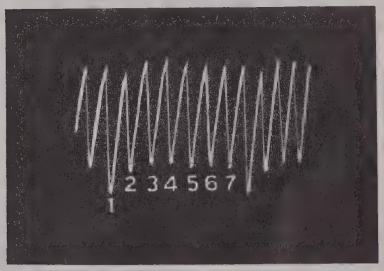
Note: Oscilloscope horizontal speed must be adjusted simultaneously with the Generator controls to keep the pattern locked on screen.

Figure A-2 -- R6 incorrect



31.5 kc multivibrator running too fast. Adjust R6 clockwise.

Figure A-3 -- R6 incorrect

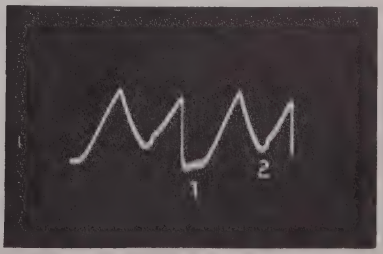


31.5 kc multivibrator running too slow. Adjust R6 counter-clockwise.

These incorrect illustrations apply in like manner to the 15.750 kc, 4500 cycle, 900 cycle, and 60 cycle multivibrators.

Figure B -- 15.750 kc. Oscilloscope horizontal speed 1/2 15.750 or 7875:

31.5 kc divided by 2 equals 15.750 kc



Counting from left to right, start with the first long pulse, counting it as #1. Adjust R34 until 2 pulses are present before the next long pulse or 1 small pulse between the long pulses.

Figure C -- 4500 cycles. Oscilloscope horizontal speed 1/2 4500 or 2250:

31.5 kc divided by 7 equals 4500~

Counting from left to right, start with the first long pulse, counting it as #1. Adjust R16 until 7 pulses are present before the next long pulse or 6 small pulses between the long pulses.

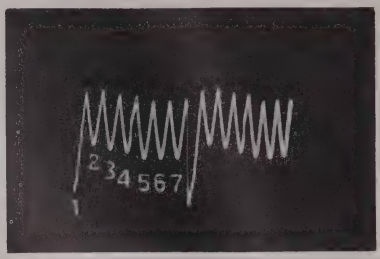


Figure D -- 900 cycles. Oscilloscope horizontal speed 1/2 900 cycles or 450:

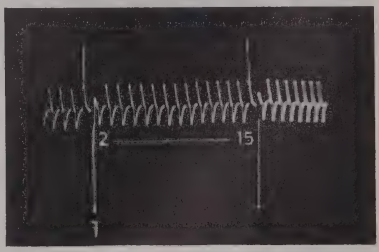
4500~ divided by 5 equals 900~

Counting from left to right start with the first wide pulse counting it as #1. Adjust R22 until 5 pulses are present before the next wide pulse or 4 narrow pulses between the wide pulses.

Figure E -- 60 cycles. Oscilloscope horizontal speed 1/2 60 cycles or 30 cycles:

900~ divided by 15 equals 60~

Counting from left to right start with the first long pulse counting it as #1. Adjust R28 until 15 pulses are present before the next long pulse or 14 small pulses between the long pulses. *



* NOTE: If 15 pulses cannot be obtained because the 60~ speed control R28 is at the end of its rotation proceed as follows:

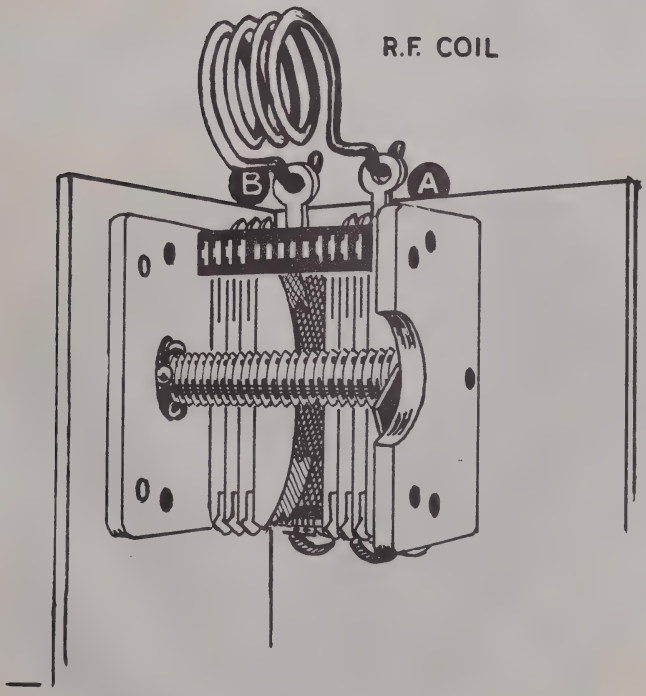
R28 control at maximum clockwise rotation. Remove the wire connecting control R28 and the 680K resistor R27. In place of the wire connect the extra 330K resistor between R28 and R27.

R28 control at maximum counter-clockwise rotation. Replace the 680K resistor R27 with the extra 330K resistor.

RF ALIGNMENT:

Connect the output cable of the Generator to the antenna terminals of a television receiver which has its fine tuning range adjusted correctly. Turn on the Generator and turn the function switch to the crosshatch position. The sound carrier switch to "on" and the video polarity switch to the positive position, the RF level control and the video level control to their maximum clockwise position. Check Figure 6 on Page 44 for correct pattern as it should appear on a television screen.

Tune the Generator and the television receiver from channel 2 to 6, checking the dial tracking. It will be observed that there are two points on the dial of the Generator on each channel where the tuning controls appears to be adjusted properly. This is because modulation is present on both the higher and lower sidebands of the picture carrier. The lower sideband being the only one that is desired makes it imperative that the tuning control of the Generator be adjusted to the correct point. This point is easily found by adjusting the fine tuning control of the television receiver to the center of its range. Then, adjusting the tuning control of the Generator, counterclockwise through the channel that the receiver is tuned to, until the pattern disappears. Then, adjust the tuning control clockwise just far enough for the pattern to reappear and the sound beat to be at a minimum. This procedure is important and should be remembered whenever the Generator is used. If the dial pointer did not indicate the correct channel in the before-mentioned procedure, continue on with the tracking adjustments. First, turn the television receiver to Channel 2, making sure the fine tuning is in the center of its range. Now adjust the tuning control of the Generator through Channel 2 to the maximum counterclockwise position. In this position there should be no pattern visible on the screen. If a pattern is visible squeeze the turns of the RF oscillator coil slightly closer together until the pattern disappears. Next, turn the TV receiver to channel 6 and the tuning control of the Generator to the maximum clockwise position. If the pattern is visible on the screen, spread the turns of the RF oscillator coil slightly until the pattern disappears. Now turn the receiver and the Generator to channel 4 and if necessary adjust the dial pointer on the shaft so that the pointer indicates channel 4.



ALTERNATE METHOD OF ADJUSTING DIVIDER CHAIN

This procedure although it takes more time may be used if there is no oscilloscope available:

First, turn on the Generator and allow 10 minutes warmup time. Adjust R6, R34, R26, R22, and R28 to the center of their range. Set the function switch of the Generator to the crosshatch position. The RF level control and the video level control to the maximum clockwise position. The sound carrier switch to the "off" position, and the video polarity switch to the positive position. Now tune in a television receiver for a picture from a TV station on any channel. Carefully adjust the horizontal and vertical hold controls of the receiver so that the picture is locked in sync. Do not adjust these controls for the balance of this procedure. Next, turn the television receiver to some unused channel from 2 to 6, adjust the height and width controls so all four edges of the raster may be seen, and connect the RF output cable of the Generator to the antenna terminals. Also adjust the Generator tuning control to the same channel as the receiver. Adjust R6 31.5 kc multivibrator control and R34 15,750 kc multivibrator control until the pattern is locked in horizontally and 10 vertical bars are visible on the screen. If difficulty is experienced here, check the setting of the Generator tuning control. Also keep in mind that the higher frequency control will affect the setting of the lower frequency control, making it necessary to adjust first one and then the other in order to reach the correct adjustment.

Next, adjust R28 60-cycle multivibrator control, R22 900-cycle multivibrator control and R16 4500 cycle multivibrator control until the pattern is locked in frame vertically and 14* horizontal bars are visible, keeping in mind that R28 60 cycles affects the vertical frame rate, R22 900 cycles affects the number of horizontal bars and the frame rate and R16 4500 cycles will affect both the vertical frame rate and the number of horizontal bars. The pattern on the screen should now look like Figure 6.

Now adjust each control individually to make sure that it is in the center of its lock-in range.

* See note on page 42.

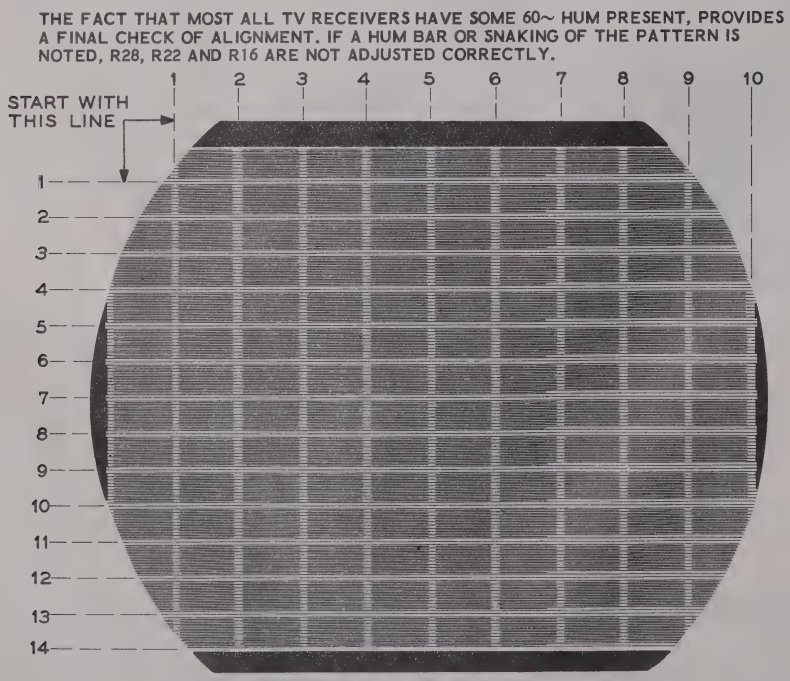
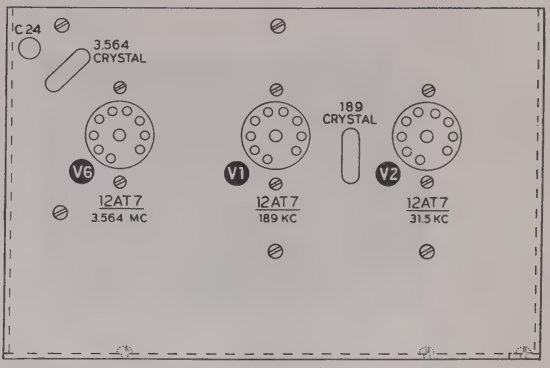


Figure 6

3.564 OSCILLATOR TRIMMER CONDENSER C24 ADJUSTMENT



To properly adjust C24, it is necessary to have a color receiver that is in good working order. First turn on the color receiver and tune in a color program from a station. Carefully adjust the hue control for the correct flesh tones. DO NOT CHANGE the hue control setting for the balance of this procedure. Now, turn on the Generator and connect the RF cable to the antenna terminals. Tune the receiver to some unused channel from 2 to 6. Make sure the tuning control of the Generator is adjusted as outlined in the RF alignment procedure. Turn the function switch of the Generator to the color bar position. Color bars should now be present, if not, adjust condenser C24. Now, to adjust the color bars in their proper order, short out the grid of the red gun of the picture tube to chassis with a 100 K resistor, then adjust C24 until the third bar from the left is the same color as the background. In other words, there should be no color in the third bar. Now, remove the 100 K resistor from the red gun. The color bars now displayed should be from left to right; No. 1; yellow-orange, No. 2; orange, No. 3; red, No. 4; magenta, No. 5; redish blue, No. 6; blue, No. 7; greenish blue, No. 8; cyan, No. 9; bluish green, No. 10; green. This completes the alignment procedure for the Generator. It is now ready to give many years of satisfactory service. The alignment of the Generator is extremely stable, and should not require readjustment except if one of the tubes in the divider chain is changed or due to the extreme aging of tubes. If one particular multivibrator should be changed for any reason it is a comparatively easy procedure to adjust the control for that particular stage, bringing the sync chain back in lock.

IN CASE OF DIFFICULTY

If the Generator fails to operate according to specifications, check over all connections for unsoldered or poor joints. Using the pictorial diagrams trace each lead with a red pencil to make sure each one is connected properly. Make sure that no component leads are shorted to each other or to the chassis, also that components such as the electrolytic condensers and silicon rectifiers are connected with the proper polarity. If after careful checks the trouble is still not located, check voltages and resistances using the charts located on page 60.

All voltages and resistance readings were taken with a Heathkit Vacuum Tube Voltmeter, with the Color Bar and Dot Generator function switch in the color bar position and the sound switch to the "on" position.

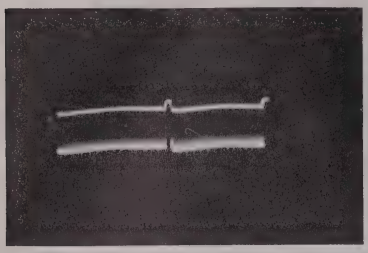
NOTE: Voltage and resistance readings may vary 20% due to line voltage changes and the tolerances of the components. A reading that is off more than 20% would indicate probable trouble in that particular stage.

Due to normal tube variations some of the multivibrator speed controls may be near the end of their rotation. Exchanging tubes such as V4 and V5 will normally rectify this condition.

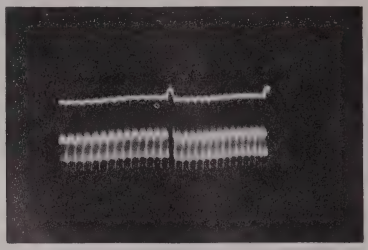
A review of the circuit description will also prove helpful by indicating where to look for the trouble.

VIDEO OUTPUT WAVE FORMS

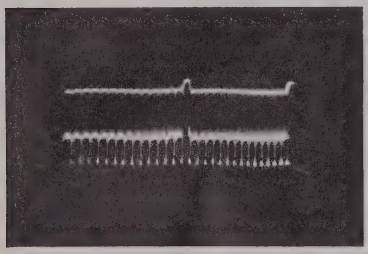
Pictures were taken using a low capacity probe on scope.



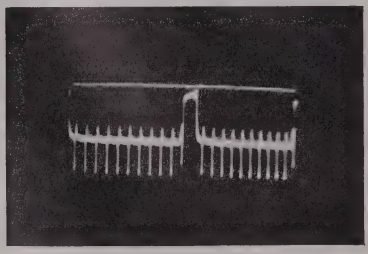
Dots
Scope Horizontal Speed 30~



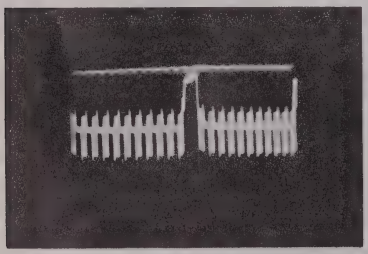
Crosshatch
Scope Horizontal Speed 30~



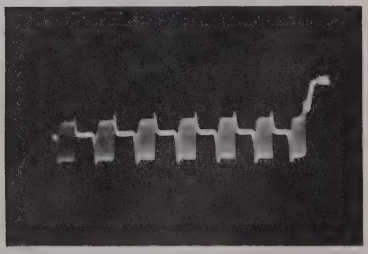
Horizontal Bars
Scope Horizontal Speed 30~



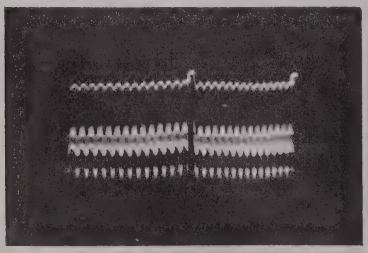
Vertical Bars
Scope Horizontal Speed 7.875 kc



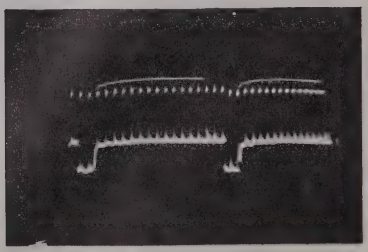
Color Bars
Scope Horizontal Speed 7.875 kc



Color Bars Expanded
Scope Horizontal Speed 15.750 kc

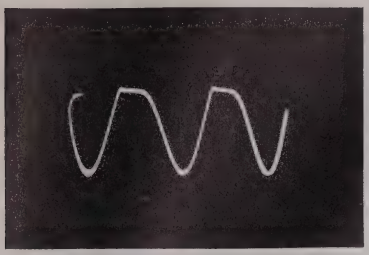


Shading Bars
Scope Horizontal Speed 30~

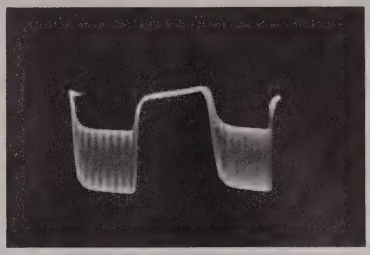


Horizontal Bars Expanded
Scope Horizontal Speed 450~

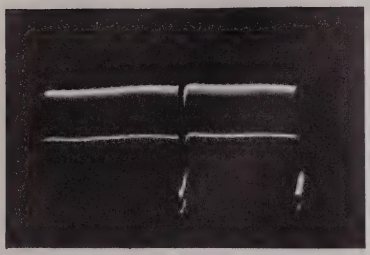
The following waveforms along with the waveform presented in the alignment procedure are provided for trouble-shooting with an oscilloscope.



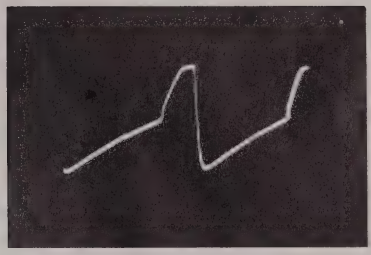
Pin 7 of V1
189 kc



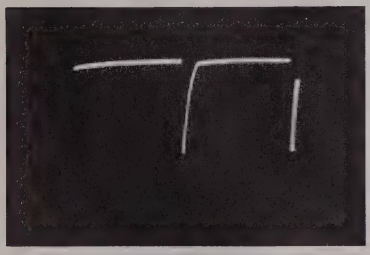
Pin 1 of V6
Color Bars



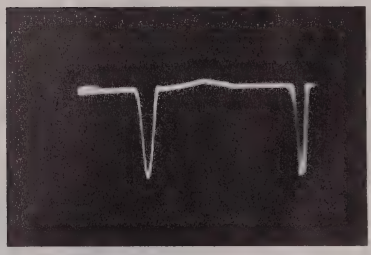
Pin 1 of V8
Vertical Sync Pulse



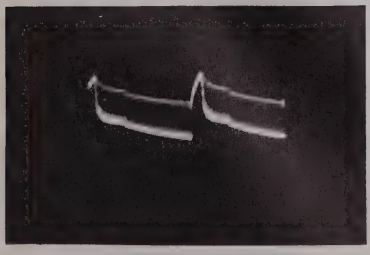
Pin 7 of V8
15.750 kc Sawtooth



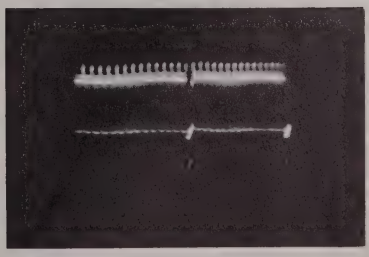
Pin 2 of V9
Horizontal Bars



Pin 7 of V9
Vertical Bars



Pin 1 of V9
Horizontal Bars



Pin 2 of V10
Crosshatch Pattern

USING THE IG-62

Convergence:

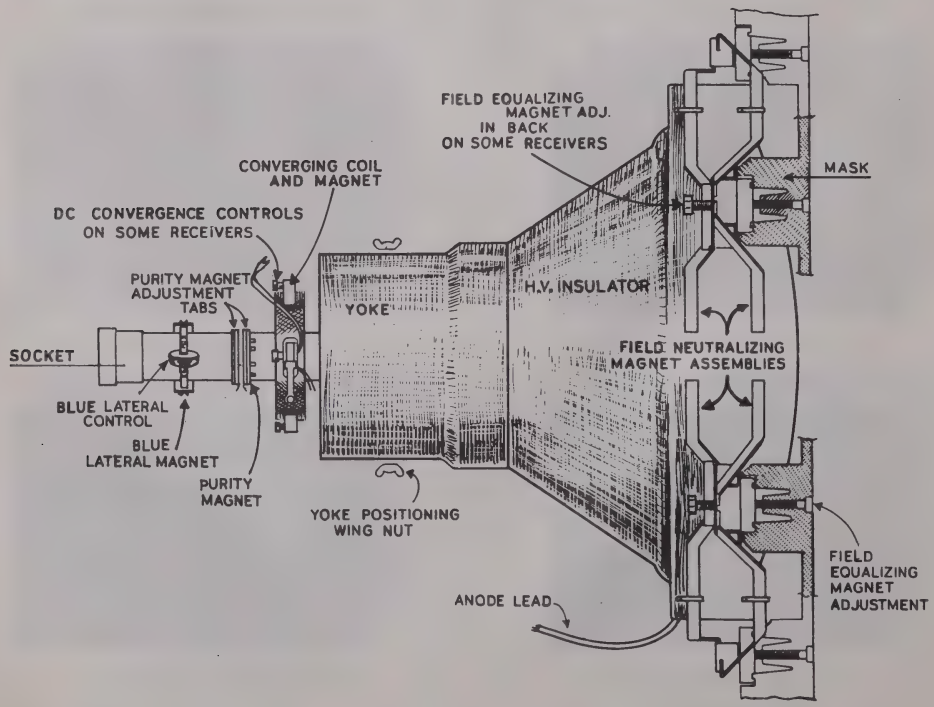
Undoubtedly, the most desirable feature for any Dot and Bar Generator is sync stability and accuracy, for it is very discouraging to spend considerable time converging a color set, then find that it is mis-converged on a program from a station.

Other desirable features are small sized, sharply defined dots and bars of sufficient number to enable the technician to check convergence over the entire screen.

It is also possible to have too many dots or bars. For an example, with vertical bars that are too close together it is possible on some sets to converge one of the guns on the wrong line or bar.

With these features in mind the Generator has been designed utilizing frequencies available in the crystal controlled sync chain to produce the 15 horizontal and 12 vertical bars (less those lost in blanking) that make up the various patterns. In the cross-hatch position these bars form a pattern with a number of rectangular blocks on the television screen. The size of the raster may be determined by counting the number of bars and the possibility of converging on the wrong line is practically nonexistant.

There are many different convergence procedures recommended by receiver manufacturers, some calling for dots, some for bars, and some for a combination of both. Each manufacturer know their receivers best, therefore their recommended procedures, in general should be followed. The Heathkit Color Bar and Dot Generator provides a pattern for most all the procedures that are now in general use. The following is a step-by-step procedure that may be used on any color receiver, using the three-gun color tube if the manufacturers notes are not available.



PURITY

① With the Generator in the dots position, connect the RF cable and tune the instrument and receiver to any channel from 2 to 6. Adjust the focus control of the receiver and adjust the contrast and brightness controls to prevent blooming.

② Retract the screen edge equalizing magnets and degauss the tube and metal cabinet parts with a degaussing coil. (CAUTION: Keep the coil away from speaker.)

③ Adjust the DC convergence controls for white dots in the center of the screen.

④ Turn the Generator to the standby position and with a 100 K resistor connected from grid to ground, or with the adjustment of the screen controls, bias or turn off the blue and green guns so that only a red screen is visible.

⑤ Adjust the purity magnet and if necessary the deflection yoke for a pure red screen. Also check for purity of the blue and green screens. NOTE: It may be necessary to readjust the DC convergence to achieve purity.

⑥ Make the screen white and again adjust DC convergence. If necessary, adjust the equalizing magnets for any color contamination around the edges of the screen.

SCREEN AND BACKGROUND ADJUSTMENTS

The many varied conditions governing grey scale tracking make it almost impossible to have a set procedure that works on every receiver. Some of these differences are in the picture tubes themselves, the number of controls present and the normal tolerance of components. Because of these factors a thorough knowledge of the affect of each control on the overall picture is of prime importance.

Consider first the blue, green and (on some receivers) red background controls. Contrary to what the word background may imply, these controls affect primarily the highlights in the picture and also the temperature of the overall screen. The red, green and blue screen controls, affect the low-lights most of all. Keep in mind that an adjustment of any screen or background control will normally necessitate an inverse adjustment of the same color background or screen control in order to maintain tracking. Keep in mind also, that the temperature of the screen refers to the shade of white and not to the brightness.

A blue-green screen temperature while perhaps providing a more pleasing black and white picture may result in a lack of good flesh tones on a color picture. A reddish-brown temperature will have little affect on a color picture, but produce an unsatisfactory black and white picture.

If the receiver manufacturers notes are available they should in principle be followed, but using the Generator in the shading bar position to provide a pattern of fixed highlights and low-lights. As explained earlier the highlights are the squares formed by the cross-over of the horizontal and vertical bars. The low-lights are the bars themselves and also the space between the bars.

STEP-BY-STEP

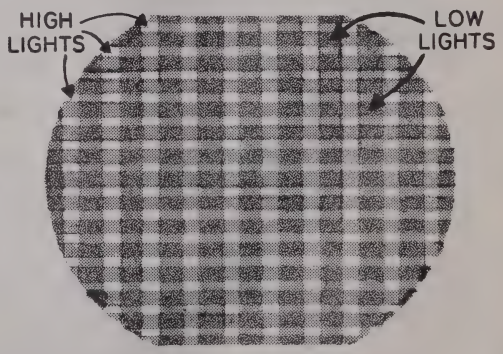
First turn the receiver and tune to any channel from 2 to 6. Allow a few minutes warmup time. Turn on the Generator and connect the RF cable to the antenna terminals. Tune the Generator to the same channel as the receiver, turn the function switch to the shading bars position and adjust the RF and video level controls to prevent overloading.

① Adjust the contrast and brightness controls through their range and observe the grey scale tracking.

② If any one color is predominate in the bright squares or highlights adjust the appropriate background control for white and then adjust the low-lights for white with the same color (or colors) screen control. NOTE: A yellow magenta or cyan predominate color would necessitate the adjustments of two controls, such as blue and green.

③ If any one color is predominate in the low-lights when the brightness control is set for a low level picture, adjust the appropriate screen control for the same temperature white as in the highlights. NOTE: An adjustment of highlights may be necessary with the same color background control. Check the receiver on a picture from a station.

④ If unable to achieve good tracking or excessive blooming is present, proceed as follows: Set the brightness control approximately 85% of clockwise rotation, the contrast control approximately 70%, the red background control approximately 30% and the blue and green screen and background controls to maximum counter-clockwise position. Now adjust the red screen control for a medium level red screen.



SHADING BARS

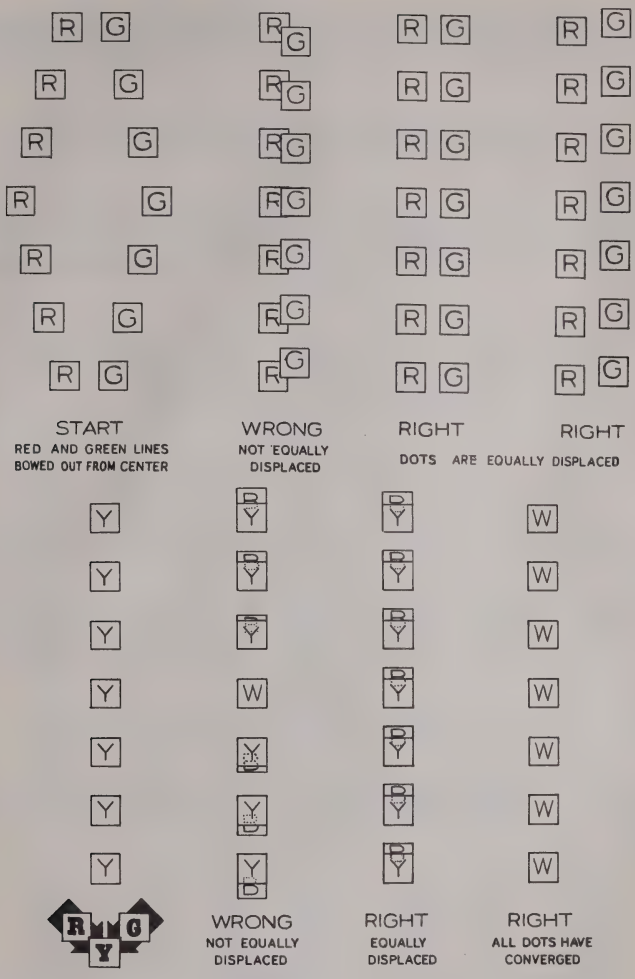
⑤ Adjust the green background control for yellow in the highlights only.

⑥ Adjust the blue background control for white in the highlights only. NOTE: The bright squares or highlights should now be white, and the low-lights should still be red.

⑦ Adjust the green screen control for yellow low-lights.

⑧ Adjust the blue screen control for the same temperature of white low-lights as in the highlights.

⑨ Repeat Steps 1, 2, and 3 if necessary. NOTE: If excessive blooming is present when brightness and contrast control are at high levels, repeat Steps 4, 5, 6, 7, and 8 using a lower setting of the red screen and background controls.



VERTICAL DYNAMIC CONVERGENCE

① Turn on the Generator and set for dots. Slightly misconverge the dots with the DC convergence controls so that the red, blue, and green dots may just be seen individually.

② Turn off the blue gun.

③ Alternately adjust the red vertical amplitude and tilt controls and the green vertical amplitude and tilt controls for equal displacement of the red and green dots up and down the vertical center row of dots.

④ With the red and green DC convergence controls make a vertical row of yellow dots in the center of the screen.

⑤ Turn the blue gun back on and with the blue vertical amplitude and tilt controls adjust the blue dots for equal displacement from the yellow dots along the same vertical center row.

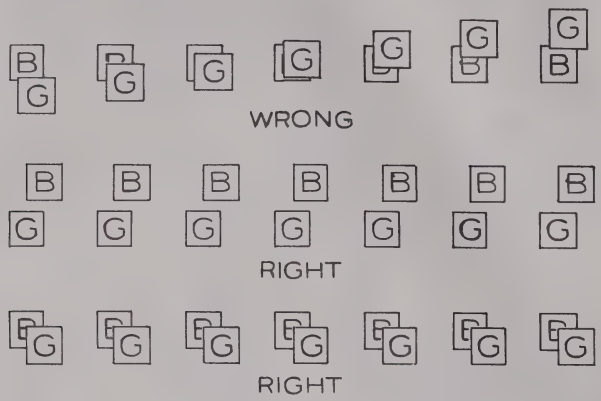
⑥ With the DC convergence controls make a vertical center row of white dots. (Touch up vertical tilt and amplitude controls if necessary).

HORIZONTAL DYNAMIC CONVERGENCE

① Turn the Generator to the horizontal bar position.

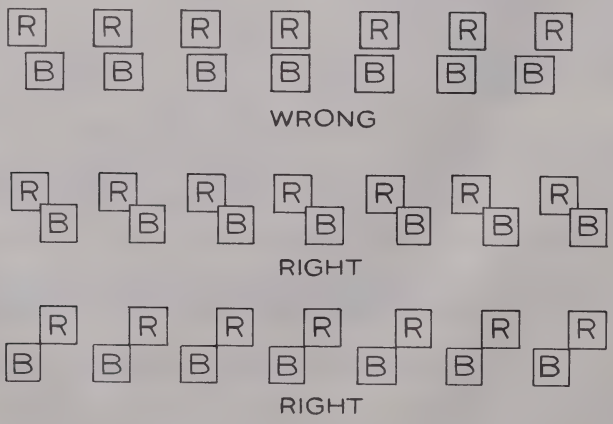
② Slightly mis-adjust the blue DC convergence control until the blue lines are just visible.

③ Alternately adjust the blue horizontal amplitude and tilt controls for a straight horizontal blue line.



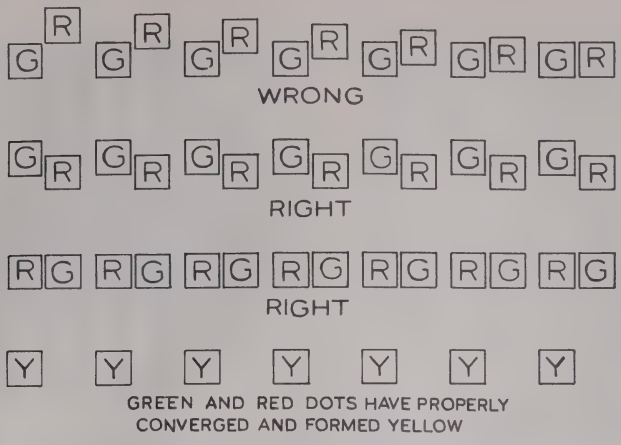
④ Turn the Generator back to the dot position and turn off the red gun.

⑤ Adjust the green horizontal amplitude and tilt control for equal displacement of the green dots from the blue dots along the horizontal center line of the screen.



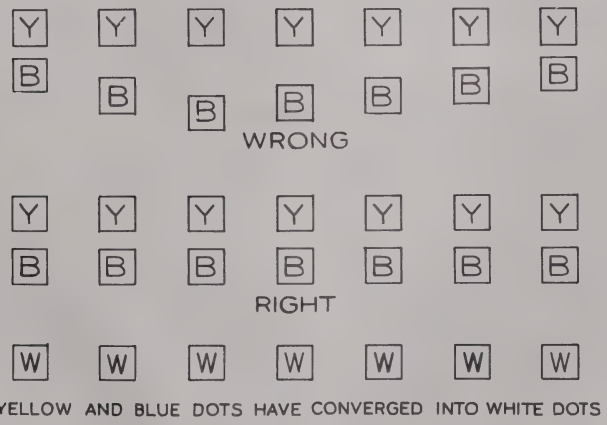
⑥ Turn on the red gun and turn off the green gun.

⑦ Adjust the red horizontal amplitude and tilt controls for equal displacement of the red dots from the blue dots along the same horizontal center line.



⑧ Turn on the green gun and turn off the blue gun.

⑨ With the DC convergence controls converge the red and green dots to make yellow dots along the same horizontal center line.



⑩ Turn on the blue gun and make white dots with the DC convergence controls. (If necessary slightly touch up amplitude and tilt controls for a uniform white dot pattern over the entire screen.

This concludes the dynamic convergence procedure. Probably the most important thing to learn about convergence is just how good a particular set can possibly be converged. As a check of this, view the receiver at a distance of at least 5" with a dot pattern present. If misconvergence can be seen at this distance, dynamic convergence is necessary.

COLOR TROUBLE SHOOTING

The Generator in the color bar position provides an excellent signal for trouble shooting color receivers. Using either RF or video output, the color bar signal may be traced through the chroma circuits with an oscilloscope. Color sync may be checked using the RF output, by turning the RF level control to minimum and then adjusting the video level control through its range. A normal receiver should stay in color sync with the video level control approximately 50% from maximum. NOTE: Make sure the fine tuning control is adjusted correctly.

COLOR ALIGNMENT

Color AVC and demodulator phasing alignment should only be attempted with the aid of the receiver manufacturers service notes that indicate the physical location of the adjustments and the procedure to be followed.

Connect the RF cable to antenna terminals and tune the receiver and the instrument to any channel from 2 to 6. Make sure the tuning procedure as outlined in the Generator RF alignment is followed. Adjust the video level control for maximum clockwise rotation and the RF level control to prevent overloading. With the aid of an oscilloscope, adjust phasing for the patterns as shown in Figure 7.

Perhaps a more convenient method is to short out the grids of the unwanted colors, at the picture tube, using 100K resistors and then adjust phasing as described in Receiver Manufacturers notes.

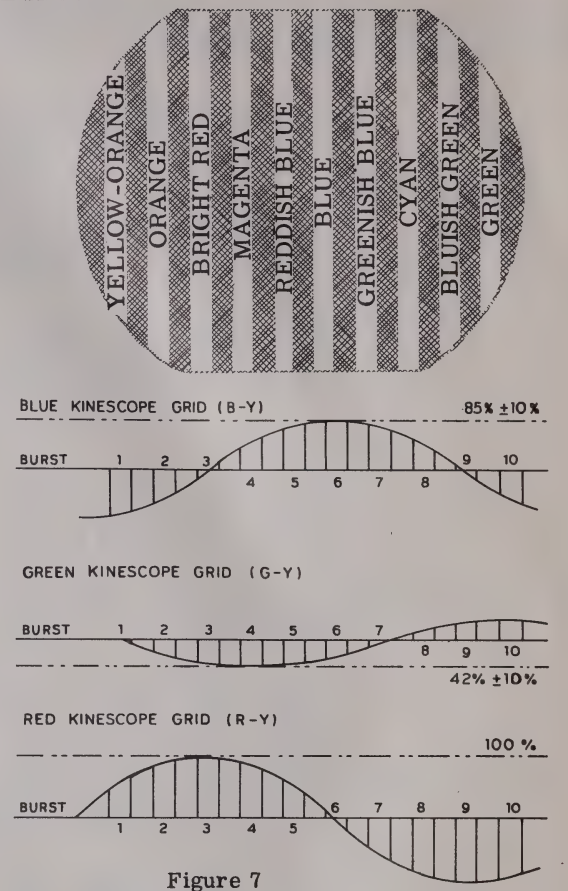


Figure 7

SERVICE

If, after applying the information in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.

2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.

3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.

4. Identify the kit Model Number and Series Number, and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)

5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed equipment to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service. HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from the Heath Company; however, it will be necessary that you verify the purchase date of your kit.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally, improper operation can be traced to a faulty component. Should inspection reveal the necessity for re-

placement, write to the Heath Company and supply all of the following information.

A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

B. Identify the kit Model Number and Series Number.

C. Mention date of purchase.

D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your instrument must be returned for service, these instructions should be carefully followed.

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Michigan 49023

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

WARRANTY

Heath Company warrants that all Heathkit parts shall be free of all defects in materials and workmanship under normal use and service, and in fulfillment of such warranty Heath Company will, for a period of three months from the date of shipment, replace any part upon verification that it is defective.

The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

The foregoing warranty is completely void if corrosive solder or fluxes have been used in wiring the equipment. Heath Company will not replace or repair any equipment in which corrosive solder or fluxes have been used.

This warranty applies only to Heath equipment sold and shipped within the continental United States including APO and FPO shipments. Warranty replacement for Heathkit equipment outside the United States is on an f.o.b. factory basis. Contact the Heathkit authorized distributor in your country or write: Heath Company, International Division, Benton Harbor, Michigan, U.S.A.

HEATH COMPANY

PARTS LIST

See inside front cover for color coding information on resistors and condensers.

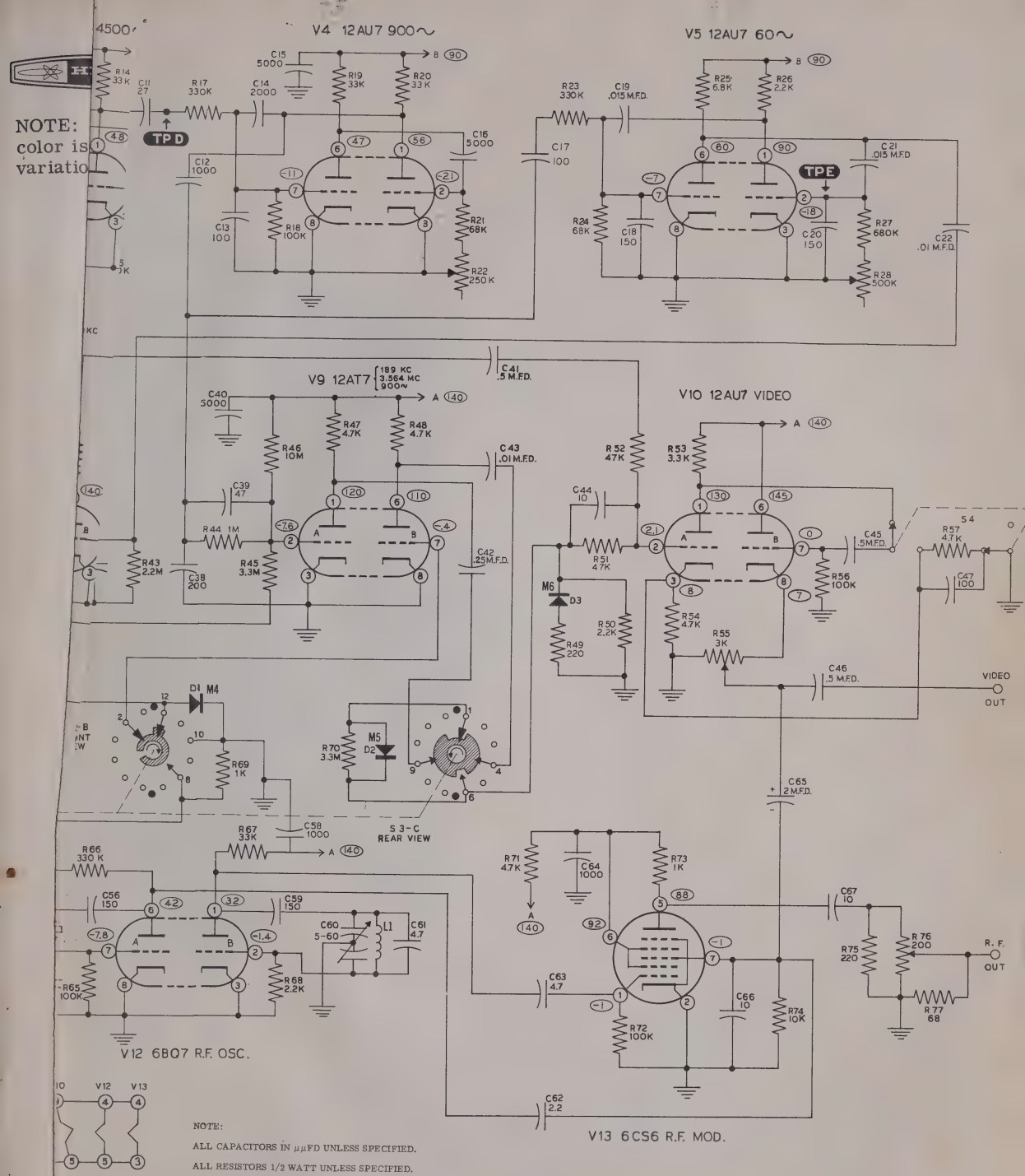
PART No.	PARTS Per Kit	DESCRIPTION
Resistors		
1-2	1	68Ω 1/2 watt (blue-grey-black)
1-9	3	1 KΩ 1/2 watt (brown-black-red)
1-14	2	3.3 KΩ 1/2 watt (orange-orange-red)
1-16	6	4.7 KΩ 1/2 watt (yellow-violet-red)
1-18	2	5.6 KΩ 1/2 watt (green-blue-red)
1-19	2	6.8 KΩ 1/2 watt (blue-grey-red)
1-20	4	10 KΩ 1/2 watt (brown-black-orange)
1-24	11	33 KΩ 1/2 watt (orange-orange-orange)
1-25	3	47 KΩ 1/2 watt (yellow-violet-orange)
1-26	6	100 KΩ 1/2 watt (brown-black-yellow)
1-31	8	330 KΩ 1/2 watt (orange-orange-yellow) *
1-34	1	680 KΩ 1/2 watt (blue-grey-yellow)
1-35	2	1 megohm 1/2 watt (brown-black-green)
1-37	2	2.2 megohm 1/2 watt (red-red-green)
1-38	2	3.3 megohm 1/2 watt (orange-orange-green)
1-40	2	10 megohm 1/2 watt (brown-black-blue)
1-44	3	2.2 KΩ 1/2 watt (red-red-red)
1-45	2	220Ω 1/2 watt (red-red-brown)
1-60	4	68 KΩ 1/2 watt (blue-grey-orange)
1A-9	1	10 KΩ 1 watt (brown-black-orange)
1B-15	1	1 KΩ 2 watt (brown-black-red)
3G-12	2	700Ω 7 watt
3G-14	1	2 KΩ 7 watt
Condensers		
20-4	2	270 μμfd silver mica (red-violet-brown or .00027 μfd)
20-11	4	100 μμfd silver mica (brown-black-brown or .0001 μfd)
20-33	3	1000 μμfd silver mica (brown-black-red or .001 μfd)
20-34	1	350 μμfd silver mica (orange-green-brown or .00035 μfd)
20-55	1	500 μμfd silver mica (green-black-brown or .0005 μfd)
20-56	4	150 μμfd silver mica (brown-green-brown or .00015)
20-57	1	2000 μμfd silver mica (red-black-red or .002 μfd)
20-61	7	27 μμfd silver mica (red-violet-black or .000027 μfd)
20-75	1	5000 μμfd silver mica (green-black-red or .005 μfd)
21-3	4	10 μμfd ceramic *
21-9	3	100 μμfd ceramic
21-11	2	150 μμfd ceramic
21-14	5	.001 μfd ceramic
21-21	2	200 μμfd ceramic
21-27	8	.005 μfd ceramic
21-29	2	4.7 μμfd ceramic
21-32	2	47 μμfd ceramic
23-28	1	.1 μfd tubular 200 V
23-41	2	.01 μfd tubular 600 V
23-56	3	.5 μfd tubular 200 V
23-63	1	.25 μfd tubular 400 V
23-80	2	.015 μfd tubular 400 V Mylar** (polyester film)
25-39	1	2 μfd electrolytic 150 V
25-48	1	40-40-40-40 μfd electrolytic 350-300-250-250 V
25-57	1	100 μfd electrolytic 200 V
26-38	1	5-60 μμfd 2 gang tuning
28-1	1	2.2 μμfd ± 20% molded phenolic
31-5	1	7-35 μμfd trimmer

*One extra for alignment.

**DuPont Registered Trademark.

PART No.	PARTS Per Kit	DESCRIPTION
Rectifiers-Crystals-Tubes		
56-4	1	Crystal diode
56-11	2	Crystal diodes (matched)
57-27	2	Silicon rectifier
404-2	1	189 kc crystal
404-3	1	3563.795 kc crystal
404-4	1	4.5 mc crystal, .050 pin
411-24	6	12AT7 tube
411-25	4	12AU7 tube
411-46	1	OB2 tube
411-71	1	6BQ7 tube
411-105	1	6CS6 tube
Terminal Strips-Connectors-Sockets		
431-10	8	3-lug terminal strip
431-11	6	5-lug terminal strip
431-12	2	4-lug terminal strip
431-14	2	2-lug terminal strip
432-1	1	Female cable connector
432-3	2	Male chassis connector
434-15	1	7-pin wafer tube socket
434-16	10	9-pin wafer tube socket
434-22	1	Pilot light socket
434-37	1	7-pin tube socket (center ground lug)
434-56	1	9-pin Bakelite tube socket
434-74	3	.050 pin crystal sockets
Wire-Sleeving		
89-1	1	AC line cord
340-2	1	length #20 bare wire
343-2	1	length RG 58 U coax cable
344-59	1	length hookup wire
346-1	1	length 1/16-1/8 sleeving
Cabinet		
90-241	1	Cabinet
203-123F770-771-772	1	Front panel, screened
211-15	1	Handle
250-83	2	#10 sheet metal screw
Controls and Switches		
10-27	1	3 KΩ control
10-33	1	200Ω control
10-57	2	10 KΩ tab. mount. control
10-58	1	100 KΩ tab. mount. control
10-59	1	250 KΩ tab. mount. control
10-60	1	500 KΩ tab. mount. control
63-3	1	2 pos. rotary SPDT switch
63-49	1	2 pos. rotary DPDT-NS switch
63-133	1	6 pos. 2 wafer function switch
63-134	1	3 pos. 1 wafer AC off stand-by on switch

PART No.	PARTS Per Kit	DESCRIPTION
Bushings-Knobs		
100-M409	1	Pointer assembly
462-187	5	Knob
462-140	2	Large knob
463-28	1	Pointer
Hardware		
208-6	1	Battery clip #8 mounting
250-2	29	3-48 screw
250-8	4	Sheet metal screw
250-9	27	6-32 x 3/8" screw
250-16	1	8-32 set screw
250-18	4	8-32 screw
250-31	3	6-32 x 1/4" screw
250-48	4	6-32 x 1/2" screw
252-1	29	3-48 nut
252-3	31	6-32 nut
252-4	4	8-32 nut
252-7	6	3-8 control nut
253-9	4	#8 flat washer
253-10	6	Nickel control washer
254-1	31	#6 lockwasher
254-2	4	#8 lockwasher
254-4	5	Control lockwasher 3/8
260-1	2	Alligator clip
261-9	4	Feet
481-1	1	Capacitor mounting plate
Miscellaneous		
40-97	1	RF oscillator coil
54-59	1	Power transformer
73-1	6	3/8 grommet
75-24	1	Line cord strain relief
259-1	4	Solder lug
259-10	3	Control solder lug
260-8	1	Clothespin antenna clip
412-1	1	#47 pilot light
421-1	1	1 1/2 amp fuse
423-1	1	Fuse holder
331-6	1	Solder
595-567	1	Manual
200-M127	1	Main chassis
200-M128	1	Crystal sub-chassis
200-M129	1	RF sub-chassis



NOTE: color is variatio

SCHEMATIC OF THE HEATHKIT® COLOR BAR AND DOT GENERATOR MODEL IG-62

PART No.	PARTS Per Kit	DESCRIPTION
Rectifiers-Crystals-Tubes		
56-4	1	Crystal diode
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57-27	2	Silicon rectifier
404-2	1	189 kc crystal
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411-25	4	12AU7 tube
411-46	1	OB2 tube
411-71	1	6BQ7 tube
411-105	1	6CS6 tube
Terminal Strips-Connectors-Sockets		
431-10	8	3-lug terminal strip
431-11	6	5-lug terminal strip
431-12	2	4-lug terminal strip
431-14	2	2-lug terminal strip
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432-3	2	Male chassis connector
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434-74	3	.050 pin crystal sockets
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89-1	1	AC line cord
340-2	1	length #20 bare wire
343-2	1	length RG 58 U coax cable
344-59	1	length hookup wire
346-1	1	length 1/16-1/8 sleeving
Cabinet		
90-241	1	Cabinet
203-123F770-771-772	1	Front panel, screened
211-15	1	Handle
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252-3	31	6-32 nut
252-4	4	8-32 nut
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254-2	4	#8 lockwasher
254-4	5	Control lockwasher 3/8
260-1	2	Alligator clip
261-9	4	Feet
481-1	1	Capacitor mounting plate
Miscellaneous		
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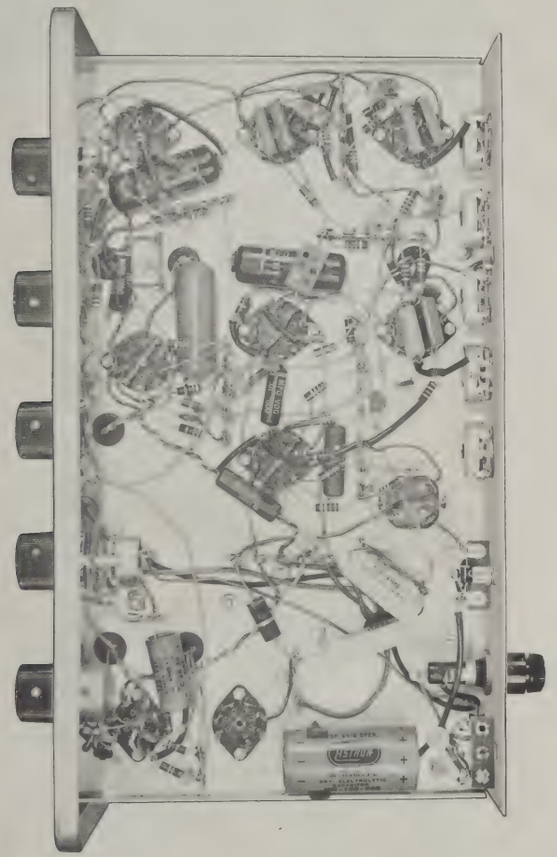
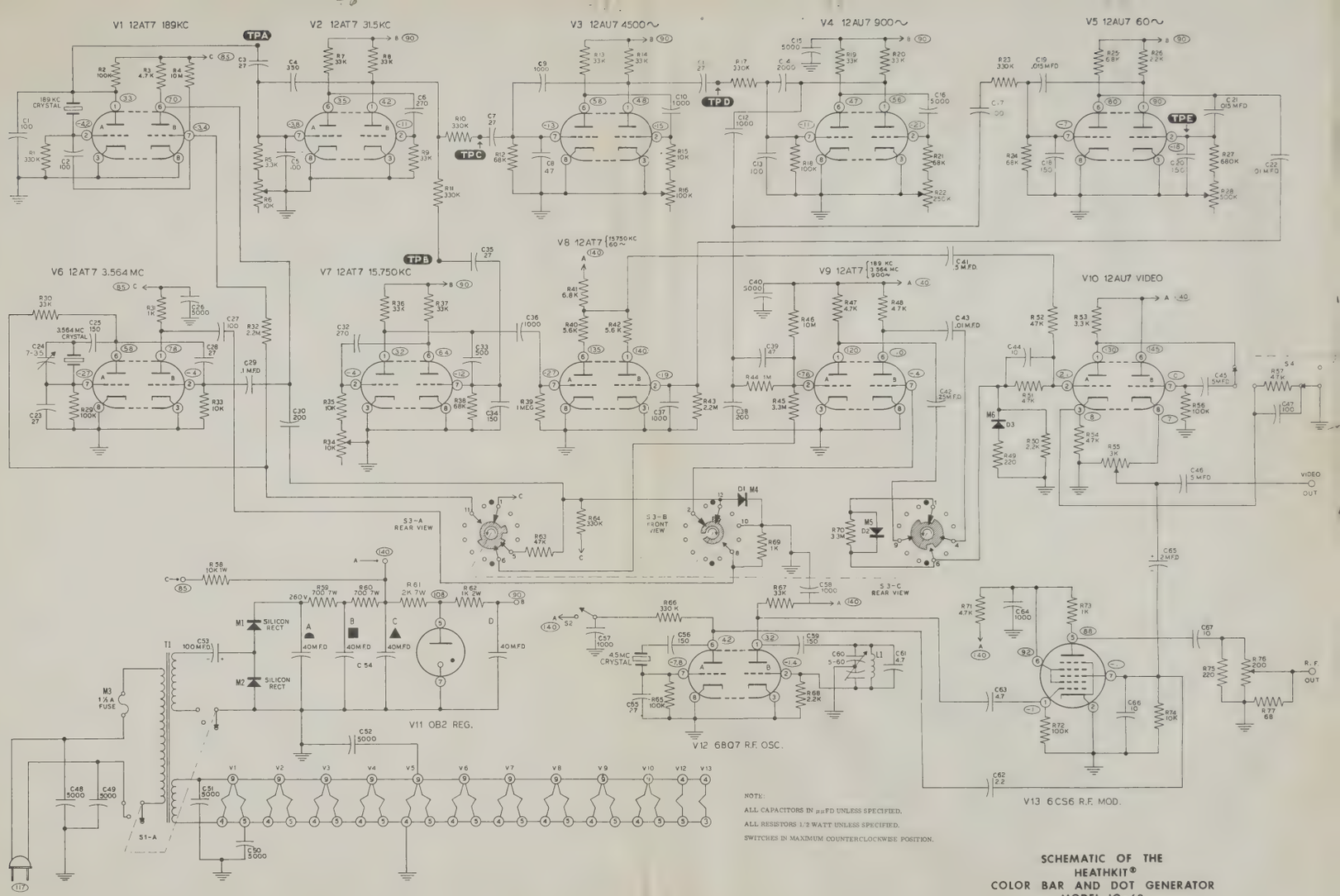
54-59	1	Power transformer
73-1	6	3/8 grommet
75-24	1	Line cord strain relief
259-1	4	Solder lug
259-10	3	Control solder lug
260-8	1	Clothespin antenna clip
412-1	1	#47 pilot light
421-1	1	1 1/2 amp fuse
423-1	1	Fuse holder
331-6	1	Solder
595-567	1	Manual
200-M127	1	Main chassis
200-M128	1	Crystal sub-chassis
200-M129	1	RF sub-chassis

NOTE: The 0B2 tube type will glow either blue or orange when in operation. The variation in color is due to the two different types of gases used in the production of the tube type. This variation in gas will in no way prove detrimental to the function of this tube.





SCHEMATIC OF THE
HEATHKIT®
COLOR BAR AND DOT GENERATOR
MODEL IG-62

VOLTAGE CHART

TUBES	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1-12AT7	+33	-4.2	0	F	F	+70	-3.4	0	F
V2-12AT7	+42	-11	0	F	F	+35	-3.8	0	F
V3-12AU7	+48	-15	0	F	F	+58	-13	0	F
V4-12AU7	+56	-21	0	F	F	+47	-11	0	F
V5-12AU7	+90	-18	0	F	F	+60	-.7	0	F
V6-12AT7	+78	-4	0	F	F	+58	-2.7	0	F
V7-12AT7	+32	-4	0	F	F	+64	-12	0	F
V8-12AT7	+140	-19	0	F	F	+135	-27	0	F
V9-12AT7	+120	-7.6	0	F	F	+110	-.4	0	F
V10-12AU7	+130	+2.1	+8	F	F	+145	0	+7	F
V11-OB2					+108		0		
V126BQ7	+32	-1.4	0	F	F	+42	-7.8	0	0
V13-6CS6	-1	0	F	F	+88	+92	-1		

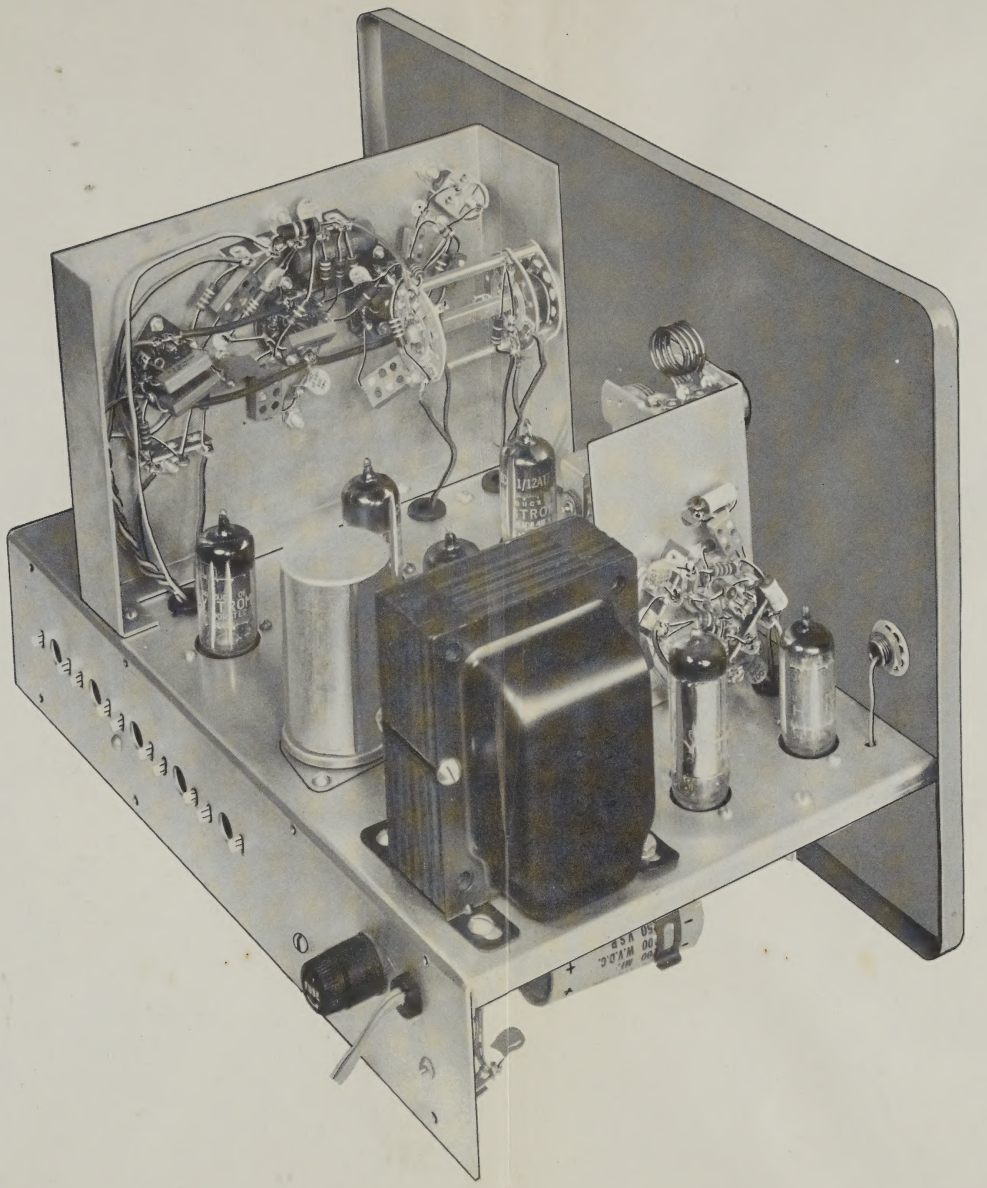
F = 6.3 VAC

All voltage and resistance readings taken with a VTVM, switch S3 in COLOR BAR position, sound switch to "ON".

RESISTANCE CHART

TUBES	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 12AT7	INF	330K	0	F	F	INF	INF	0	0
V2 12AT7	INF	33K	0	F	F	INF	*	0	0
V3 12AU7	INF	*	0	F	F	INF	68K	0	0
V4 12AU7	INF	*	0	F	F	INF	100K	0	0
V5 12AU7	INF	*	0	F	F	INF	68K	0	0
V6 12AT7	INF	10K	0	F	F	INF	100K	0	0
V7 12AT7	INF	*	0	F	F	INF	68K	0	0
V8 12AT7	INF	2.2m	0	F	F	INF	680K	0	0
V9 12AT7	INF	INF	0	F	F	INF	2.2K	0	0
V10 12AU7	INF	50K	2.3K	F	F	INF	100K	3K	0
V11 OB2					INF		0		
V12 6BQ7	INF	2.2K	0	F	F	INF	100K	0	0
V13 6CS6	100K	0	F	F	INF	INF	10K		

INFINITY VARIES WITH CHARGE ON FILTER CONDENSER
*Varies with control.



VOLTAGE CHART

TUBES	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1-12AT7	+33	-4.2	0	F	F	+70	-3.4	0	F
V2-12AT7	+42	-11	0	F	F	+35	-3.8	0	F
V3-12AU7	+48	-15	0	F	F	+58	-13	0	F
V4-12AU7	+56	-21	0	F	F	+47	-11	0	F
V5-12AU7	+90	-18	0	F	F	+60	-.7	0	F
V6-12AT7	+78	-4	0	F	F	+58	-2.7	0	F
V7-12AT7	+32	-4	0	F	F	+64	-12	0	F
V8-12AT7	+140	-19	0	F	F	+135	-27	0	F
V9-12AT7	+120	-7.6	0	F	F	+110	-.4	0	F
V10-12AU7	+130	+2.1	+8	F	F	+145	0	+7	F
V11-OB2					+108		0		
V126BQ7	+32	-1.4	0	F	F	+42	-7.8	0	0
V13-6CS6	-1	0	F	F	+88	+92	-1		

F = 6.3 VAC

All voltage and resistance readings taken with a VTVM, switch S3 in COLOR BAR position, sound switch to "ON".

RESISTANCE CHART

TUBES	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 12AT7	INF	330K	0	F	F	INF	INF	0	0
V2 12AT7	INF	33K	0	F	F	INF	*	0	0
V3 12AU7	INF	*	0	F	F	INF	68K	0	0
V4 12AU7	INF	*	0	F	F	INF	100K	0	0
V5 12AU7	INF	*	0	F	F	INF	68K	0	0
V6 12AT7	INF	10K	0	F	F	INF	100K	0	0
V7 12AT7	INF	*	0	F	F	INF	68K	0	0
V8 12AT7	INF	2.2m	0	F	F	INF	680K	0	0
V9 12AT7	INF	INF	0	F	F	INF	2.2K	0	0
V10 12AU7	INF	50K	2.3K	F	F	INF	100K	3K	0
V11 OB2					INF		0		
V12 6BQ7	INF	2.2K	0	F	F	INF	100K	0	0
V13 6CS6	100K	0	F	F	INF	INF	10K		

INFINITY VARIES WITH CHARGE ON FILTER CONDENSER
*Varies with control.

TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.

HEATH COMPANY

BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

595-567

LITHO IN U. S. A